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Aerospace Crew Equipment Department

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COMPARATIVE STUDY OF BODY DISPLACEMENTS IN BOTH HUMANS AND ANTHROPOMORPHIC DUMMIES WHEN SIMULTANEOUSLY SUBJECTED TO CONTROLLED VERTICAL IMPACT TYPE DECELERATIONS

PHASE REPORT
FOUNDATIONAL RESEARCH PROJECT #15

This interim report concerns Phase I of a research program to determine if a correlation in displacements exists between humans and anthropomorphic dummies of like proportions when subjected to vertical crash type forces for extrapolation into the high impact region where only dummies can be utilized. Although similarities were found when comparing the displacements in the leg area, the upper torso could not be correlated in any but a highly complex way. Although direct correlation is not practical, much useful information has been gained. The dynamics of the human body as it affects the performance of pilot ejection systems is considered to be very significant, and as yet undetermined.

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S U M M A R Y

INTRODUCTION

The study contained in this report is only one phase of a Foundational Research program established to determine an optimum system for both ejection and non-ejection type seat design for the attenuation of high G vertical forces which result from high impact landings or crashes. The program consists of three phases:

PHASE I - To determine what, if any, correlation exists between humans and anthropomorphic dummies when subjected to crash forces for extrapolation into the high impact region where only dummies can be utilized.

PHASE II - To determine the effects of various G loadings on the human vertebra to show more clearly, the mechanisms responsible for spinal injury.

PHASE III - To determine systems and materials that can be used most effectively to attenuate to a tolerable limit, the vertical forces imposed by high impacts in both ejection and non-ejection type seats.

This interim report deals with Phase I. Although work in Phase I has not been completed, this report is submitted to make available, information that has been gathered to date. Future reports will be submitted as significant phases of development are reached.

RESULTS AND CONCLUSIONS

Tests were conducted in which humans and dummies of like proportions were dropped simultaneously on the Aerospace Crew Equipment Department Vertical Drop Tower and decelerated under various controlled deceleration impulses. Both dummies and humans were similarly restrained in identical seats and seated platforms. Body displacements at various pre-selected points were recorded by high speed motion picture cameras, which were analyzed later and plotted by automatic readout equipment for comparison.

The thigh point and knee point of the 95 percentile human and dummy both reached their peak displacement (P.D.) at .040 sec. The displacements of both are practically identical at the higher G levels. At the lower G levels, the P.D.'s were, in almost all cases, no greater than 3/8" apart. Therefore, it can be concluded that there is no significant difference in the response of the legs of both the human and dummy when subjected to a vertical input while positioned in the normal ejection seat configuration.

The results of the 5 and 50th percentile human and dummy thigh and knee points are very similar, although not as conclusive as the 95 percentile data.

The shoulder point of the 95 percentile human reached its P.D. at .080 sec. This is attributed to the natural frequency of the human body, and agrees with data contained in Report NAEC-ACEL-510. The .060 sec. response time for the dummy evidences a more rigid body with a natural frequency higher than that of the human. It is clear that the dummy responds to the input pulse quicker than the human, which is again due to the dummy being a more rigid body. It is also interesting to note the similarity in the general shape of the displacement-time curve which appears to contain a double peak, particularly in those tests with a longer time pulse. The shoulder point is the area where the greatest amount of displacement occurs in the human. The dummy data shows that the head points resulted in the largest displacements. This was because the dummy head joint was not locked tight and was able to rotate completely forward. On the other hand, the human, within the G levels tested, was able to maintain sufficient muscle control to keep his head back in almost all cases. This also explains why the time to peak acceleration and P.D. for the dummy's head varies. This variance is not as evident for the human. Further testing with dummies will henceforth be done with the head joint sufficiently tightened to preclude excessive rotation.

The displacement of the upper torso of the human varies considerably from that of the dummy and cannot be correlated in any but a highly complex way, if at all.

The dummy shoulder point tends to approach a maximum, as indicated by the data up to the limits tested. The human shoulder point continues displacing as the load is increased. This data can be used for direct comparison only within the limits tested. Based upon the experiences gained from this study, it would be difficult to duplicate exactly, the motion of the head and shoulder points under the same test conditions, because of the following variables:

1. The position in which the subject places himself in the seat, especially how he holds or "hunches" his shoulders.

2. The position in which the subject holds his head.

3. The degree of tightness with which the subject straps himself into the seat.

4. The extent of the subjects muscular control during the deceleration pulse.

The dynamics of the human body as it affects the performance of pilot ejection systems is considered to be very significant and as yet, undetermined. It is obvious that there is an important need for a dummy with the same stiffness and dampening characteristics as a live human being, in order to evaluate ejection seat systems properly for the use to which they were intended. This also includes evaluation of all the necessary support and restraint system components on the seat.

RECOMMENDATIONS

In order to obtain more complete information required to design dummies to simulate the response of a human, it is recommended that further research be directed toward the comparative study of impact response. The results of such a study can also be used in the analysis of impact energy absorption phenomena.

This activity is presently conducting a research program in conjunction with Technology Incorporated of Dayton, Ohio, to collect basic data which may be used in the analysis of impact energy absorption phenomena and the comparative study of impact response of humans and anthropomorphic dummies. To accomplish this task, an experimental design has been established, which is presently being implemented for the physical test set-up, instrumentation requirements and test procedures. Upon completion, live and dummy impact tests will be conducted on the ACED vertical drop tower to obtain data for use in the development of a computer program to reflect the test facility characteristics and to yield analytical models capable of duplicating force response for both humans and dummies. The development of these models will establish (1) the capability of computing the dynamic force generated between the human body and its support system for any applied acceleration environment; and (2) the difference between the dynamic response of the dummy and the human body.

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D I S C U S S I O N

These tests are being conducted to determine the reactions of anthropomorphic dummies and humans of similar proportions when subjected to vertical crash type loads under identical test conditions. In this phase of the program, we are gathering data to determine the physical displacements that take place to compare the motion of the human and the dummy. It was hoped that some correlation would exist so that we may be able to obtain the motion that the human undergoes at the higher G levels which cannot be live tested. Since all ejection seat test work is accomplished with the similar anthropomorphic dummies, it is of great interest to be able to determine the effect upon the seat system performance characteristics when the dummy is replaced with a human.

Before live testing could begin, it was necessary to calibrate the Drop Tower. The calibration consisted of determining the proper drop weight and arresting force combination to insure close control of the desired G level and the proper drop height to insure close control of the time duration of the deceleration pulse.

After the final payload was determined, an arrangement of arresting straps was selected and a series of drop tests were conducted at various heights. This was repeated for each required G level. Utilizing the maximum drop weight allowable and the limited number of various straps available, the G levels obtained were 4.9, 7.1, 9.0 and 10. Using known parameters of G, time and height, a family of curves were drawn for determining height required to produce a desired time pulse for the four different G levels tested.

A test stand was designed and constructed to allow the mounting of two A4D ejection seats back-to-back (Figure No. 1). The A4D seats were chosen because they are light in weight and were readily available. Both the live subjects and the dummies were seated on identical type rigid seat survival kits.

Instrumentation consisted of the following: A total of four accelerometers were placed on the dummy. Two were located in the dummy's head and two in the chest cavity which measured vertical and horizontal decelerations. There was only one accelerometer placed on the live subject. This was attached firmly on the subject's head and held in place by the helmet, which was drilled, allowing the accelerometer to protrude through.

This was the only location considered feasible for placing an accelerometer on the live subject, because of the inability to fix the accelerometer to other parts of the body in a way which would prevent relative motion between it and the body during the deceleration. An accelerometer was placed on the deck of the drop cart, between the two seats. A velocity pick-up was installed to measure the drop cart speed at impact.

The first live testing on the ACED vertical drop tower facility was accomplished during this Phase I program. The first drop test was made by the author to determine an adequate test procedure, to check out instrumentation and photographic coverage, and to experience the physiological factors involved.

High speed motion picture camera techniques were employed to detect body movements during the deceleration impulse. Three milliken 400 FPS cameras were positioned on the drop cart, such that one camera covered the live subject, one the dummy, and the third the shoulder motions of both dummy and live subject. Strobe lights were mounted behind each seat to record, on film, the start of the deceleration impulse. Both were actuated at exactly the same time by a single switch at the instant of impact.

Three subjects, representing approximately, 20th, 65th and 95th percentiles, volunteered to complete a series of four drop tests each. All were subjected to the same four tests, which were programed as follows:

G-Level	Time Duration	Impact Velocity
4.9	.330 Sec.	44 F.P.S.
7.1	.250 Sec.	44 F.P.S.
9.0	.160 Sec.	30 F.P.S.
10	.140 Sec.	30 F.P.S.

Each of the test subjects had reference marks placed on his body at four different locations for film analysis of body displacements:

1. Forehead (Frontal Ridge)
2. Shoulder (Acromian Process)
3. Thigh - 1/3 distance between knee and greater trochanter
4. Knee (Lateral aspect of the Patella)

In addition to these four reference marks, the eye and the tip of the nose were also used as reference marks to detect body displacement. Similar marks were placed on the dummy in approximately the same locations, with the exception of the temple, which was not marked on the dummy.

The high speed films were analyzed on a 16MM Boscar Film Analyzer to detect body movement at each of the six reference points. Each point was recorded every eight frames for the first 56 frames; then every 25 frames till motion ceased. At the moment of impact (indicated by illumination of a strobe light), all six reference (five on the dummy) points were noted and marked. These marks were referenced to a common grid representing horizontal and vertical axis. The purpose of the grid was to provide a scale factor for the analyzer and a zero reference from which to measure all displacements. Approximately 14 points were plotted on a 600 MS time base. This information was simultaneously fed into an IBM 026 card punch machine and printed on standard IBM punch cards. After all the films had been analyzed, the punch cards, including scale factor and zero reference information, were fed into an ALWAC Model III-C Digital Computer from which a tabulated read-out for each drop tower test was obtained (Tables 2, 3, and 4). This read-out gave displacement data in inches correct to the second decimal place for each body reference point in relation to a fixed reference axis common to both the live subject and the dummy. This information was then placed on another set of punch cards and these in turn were fed into an E.A.I. Electronic Data Plotter which translated the tabulated digital information into data plots on two coordinate paper. (Figures 2 through 106).

Results of 95 Percentile Tests

SHOULDER POINT

Vertical - While the input deceleration was acting on the human, the maximum displacements in all the tests utilizing the 95%tile subject occurred between 80 and 100 milliseconds. In five out of 6 tests, the maximum displacement occurred at exactly 80 milliseconds. For the dummy under the same conditions, 5 tests had peak displacements occurring at exactly 60 milliseconds. All these tests were at different 'G' levels and varying drop heights. The peak displacement (herein referred to as P.D.), in each test increased as the 'G' level increased. The dummy shoulder displacements tended towards a maximum at about 10 'G', which was the highest 'G' level tested in this series. The human displacements kept increasing as the 'G' level was increased. The more force that is applied, the more the displacement because of the flexibility of the human body.

Horizontal - As evidenced by the data plots, the human subject tended to lean into the shoulder harness after rebounding off the back of the seat, whereas the dummy in all cases was pressed back into the seat. The amount of displacement of the live subject in the horizontal direction was clearly seen to be dependent primarily upon how tight the subject strapped himself in before each test drop. Obviously, the more slack in the harness, the greater the tendency to displace forward. In Test #60, the subject tightened the shoulder harness as much as comfort allowed. This kept him back in the seat with little forward displacement. In Test #61, the subject purposely did not tighten himself as much, although he was still reasonably tight. As expected, the subject experienced the same type of response, but with more forward and less aft movement.

The dummy was strapped in only once before the test series, and its horizontal movements were practically similar throughout. The c.g. location of the torso, together with the position assumed by the subject in the seat, will determine whether the subject leans into the harness or is pressed back into the seat during the deceleration input pulse.

THIGH POINT

Vertical - The thigh point of the human during the deceleration pulse reached a P.D. in the first test of the series, at 4.9 G's. In all succeeding tests the deflections remained fairly constant at all 'G' levels. The peak displacements in all tests occurred between 100 and 120 milliseconds, with the greater percentage occurring at 100 milliseconds. For the dummy under the same conditions, the deflections became constant at approximately 7.6 G's. The time for the dummy's thigh to reach its peak displacement during the initial deceleration pulse was constant at 40 milliseconds despite varying input parameters.

It was not expected that the motion of the thigh point of the human would be similar to his shoulder motion, since the deflection of the thigh is limited due to the rigid platform supporting it and the physiology of the thigh region.

On the other hand, the motion of the thigh point and shoulder point of the dummy was similar. This was as expected because of the rigidity of the dummy construction which prevents any relative motion between its joints in the vertical direction. The dummy is free to rotate only about its joints and cannot simulate compression of its internal structure in the input direction, as is possible in the human.

Horizontal - The thigh point on the human displaced forward, although its maximum movement never exceeded .43 inches. This, of course, is considered very stable.

The dummy thigh was also extremely stable in that it displaced less than the human, but in the aft direction. Any large horizontal displacement of the thigh that might occur could primarily be attributed to submarining.

KNEE POINT

Vertical - Both the human and the dummy exhibited the same type of response, although in the human the vertical deflections were slightly larger. The times required to reach peak displacement for both were similar at 40 milliseconds.

The horizontal displacement of the human knee reached a maximum of .81 inches in the forward direction. The dummy displacements were very constant throughout the entire test series, reaching a maximum of only .2 inches.

HEAD

Although it is believed that no meaningful correlation can be made between the head points of the human and dummy because of the different types of motion that took place during the deceleration pulse, the displacements obtained are useful for predicting what each will do.

TEMPLE

Vertical - From the data plots, it is apparent that there is a fairly predictable pattern to the vertical head displacement. (Disregarding Test #35). The displacement of the head is a combination of the downward displacement of the torso and the rotation of the head with the greater percentage being attributed to downward displacement of the torso in the case of the human.

Horizontal - The horizontal displacements of the human temple point are random and completely unpredictable. The motion does indicate that the point is moving forward. The corresponding point on the dummy was not considered in this test series.

EYE POINT

Vertical - The eye point in the human followed a very definite pattern of increasing vertical displacement with increasing 'G' level. With the exception of Test #35, the displacements appear to approach a linear relationship. The dummies eye point in the vertical direction displaced more than the human, but this is due mainly to the forward rotation of the dummies head.

Horizontal - The motion of the humans eye point tended towards a maximum forward displacement at the 10G level, which was the highest G level tested. The dummies eye point also displaced in the forward direction. The dummies eye displacement far exceeded the humans, due to the greater amount of forward rotation of the dummies head. For future dummy use, the head should be adjusted by tightening, to more closely resemble the motion of the human.

NOSE POINT

Vertical - Both the human and dummy nose reference points show a consistent increase in displacement with each increase in the 'G' level. The human showed no tendency to reach a maximum, while the dummy tended to reach a constant peak displacement at the 8 G level. The vertical displacements resemble those which were obtained for the eye point.

Horizontal - The horizontal motion of the human's nose reference point was very similar in magnitude to that of the eye point. This is evidenced by an increasing displacement with increasing G level in some predictable manner.

The dummies nose point, on the other hand, did not displace as much as its eye point. At first glance this would seem to be inconsistent. However, the values obtained are realistic and this is due to the amount of rotation of the dummies head. Because of the respective locations of temple, eye, and nose, and the geometry of the motion, a rotation of the head about a fixed point will usually result in three different absolute displacements in the X and Y direction for each point. If no rotation had occurred, the displacements would be expected to be similar.

Results of 5 Percentile Tests

AMH-2 REED & 5 PERCENTILE DUMMY
SHOULDER

Vertical - The 5 percentile human subject tended to continue displacing during the entire time that the input pulse was being applied. This is in contrast to the 95 percentile subject which reached a P.D. in the early part of the input pulse. The 5 percentile dummy displacements were similar to the 95 percentile in that they reached a P.D. in the early portion of the deceleration, although not at the same time.

The human's displacement increased slightly with each increase in G level, except for the last test which decreased slightly. This may or may not indicate an absolute P.D. For the human 95 percentile tests, no absolute maximum was indicated, as was pointed out earlier. The 5 percentile dummy reached a P.D. during the first test at 4.7 G's and remained very constant for the remainder of tests. This compares favorably with the 95 percentile dummy. Both the 5 and 95 percentile dummies compare closely at each G level.

Horizontal - In this series of tests, the dummy horizontal motion was very stable at all G levels. The human's motion is clearly seen to be an increasing peak displacement with each increase in G level. The direction of displacement was forward into the harness, as was the 95 percentile human.

THIGH

Vertical - The peak displacement of the dummy's thigh never exceeded .65 inches and was essentially the same in every test. The human's peak displacement varied between .69 inches and 1.29 inches. The peak displacements of the 95 percentile dummy were consistently higher than the 5 percentile dummy, but never more than approximately .5 inches. The displacements of the 95 percentile human were less than the 5 percentile human in each corresponding test.

Horizontal - The peak displacements of the human's thigh were very stable at .42 inches in the forward direction and compared closely with the motion of the 95 percentile subject. The dummy's displacements were very small except for the last test at 9.6 G's, which reached a peak of 1.32 inches during the first .4 seconds of the deceleration pulse and then decreased to no more than .3 inches for the remainder of the pulse. The dummy's displacements were forward as compared to the 95 percentile dummy which had a tendency to displace aft, as well as forward.

KNEE

Vertical - The human knee point peak displacements increased with each successive increase in G level, as did the 95 percentile human, although the 95 percentile human's displacements were larger at the higher G levels. The dummy's displacement also increased very slightly with increasing G level, excluding the first test. The 5 percentile dummy displacements were slightly less than the 95 percentile dummy displacements.

Horizontal - The motion of the human's knee in the horizontal direction shows that the displacement is in the forward direction. The displacements increased with increasing G level with the exclusion of the last test which was slightly less than the preceding test, but more than the first two. The magnitudes of the P.D.'s were similar to that of the 95 percentile human.

With the 5 percentile dummy, the knee displaced slightly forward and aft during the first test at the 4.9 G level. The remaining tests all displaced forward. The only significant displacement occurred during the last test at the 9.8 G level. In this test, the peak displacement of the knee reached a maximum of 1.18 inches at .02 seconds of the pulse and then returned to a maximum of .27 inches for the second half of the pulse.

HEAD POINTS

The photographic coverage of the temple, eye, and nose points of both the human and dummy were not obtained to any usable degree for analysis purposes, due to excessive shadows cast by the drop tower structure on both the human and dummy.

Results of 50 Percentile Tests

HM2 BRICE & 50 PERCENTILE DUMMY
SHOULDER POINT

Vertical - The P.D. of the subject approximating a 50 percentile human reached a maximum at the 8.3 G level and showed a slight reduction in displacement at the next higher G level. This pattern of motion is identical to the subject representing the 5 percentile, although the magnitude of the displacements vary. From these tests, there does not appear to be any correlation between the various percentile humans and the magnitude of the displacements at the various G levels.

The dummy maximum displacements increased slightly with each increase in G level which is similar to the 95 percentile dummy, but in contrast to the 5 percentile, in which the P.D.'s were fairly constant.

Horizontal - During the first two tests with the human subject, the shoulder point moved fore and aft throughout most of the deceleration pulse. In the third test at 8.3G's, the subject tended to move slightly forward. In the last test, the subject's shoulder point tended to displace slightly aft. The 50 percentile dummy displaced aft in all the tests. All of the horizontal displacements, both fore and aft, of human and dummy, were less than one inch.

THIGH

Vertical - The human's maximum thigh displacement never exceeded .8 inches in any of the tests. This compares with the 95 percentile subject whose P.D.'s never exceeded .91 inches and the 5 percentile human's P.D., which reached approximately 1.28 inches at both 4.7 G's and 9.6 G's. The dummy's P.D. points varied between .8 inches and 1.3 inches.

Horizontal - The direction of the human's horizontal displacement was forward and never exceeded .6 inches. The dummy's displacements were for all purposes aft, as was the case with the 5 and 50th percentile dummies. The displacements never exceeded .54 inches.

KNEE POINT

Vertical - The displacement of the human's knee point was seen to vary only slightly from one test to another. The displacement of the human's knee point was consistently greater than that of the dummy. The dummy's P.D. was .79 inches. With the exception of the first test, the human's knee point displacement increased slightly with each increase in G level.

The dummy P.D.'s were not consistent with an increase in G level.

Horizontal - The horizontal P.D. for both the human and dummy was extremely small. The human's displacement reached a peak of .6 inches in the forward direction. The dummy's P.D. was only .34 inches, but in the aft direction, as had been the case in the two preceding test series.

TEMPLE POINT

Vertical - The displacement of the human's temple point increased with each increase in G level. The P.D.'s are very similar to those of the 95 percentile human and are a combination of the downward displacement of the torso and rotation of the head. This point was unobtainable on the 5 percentile human. Only three data points were obtained for the 50 percentile human.

Horizontal - The P.D.'s of the 50th percentile human's temple point were greater than those of the 95 percentile. At the highest G level tested, the 50th percentile's P.D. was about 1.3 inches greater than that of the 95 percentile. The horizontal motion of the head points do not necessarily have to follow the horizontal motion of the shoulder. In this case they certainly do not. The head can rotate and stretch forward while the shoulders press aft into the seat.

EYE POINT

Vertical - Only two data points were obtained for both the human and dummy, and the only indication is that the dummy vertical displacements are greater, as they were in the 95 percentile series. The horizontal data is inconclusive.

NOSE POINT

Vertical - The human's P.D.'s were fairly constant. The dummy's displacements were slightly larger due to a greater amount of rotation of the dummy's head as was the case with the 95 percentile series.

Horizontal - The human's horizontal P.D.'s were also fairly constant and, in the horizontal direction, the dummy's P.D.'s were less than those of the human.

A C K N O W L E D G E M E N T S

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David Brice HM2
Lynn L. Reed AMH2

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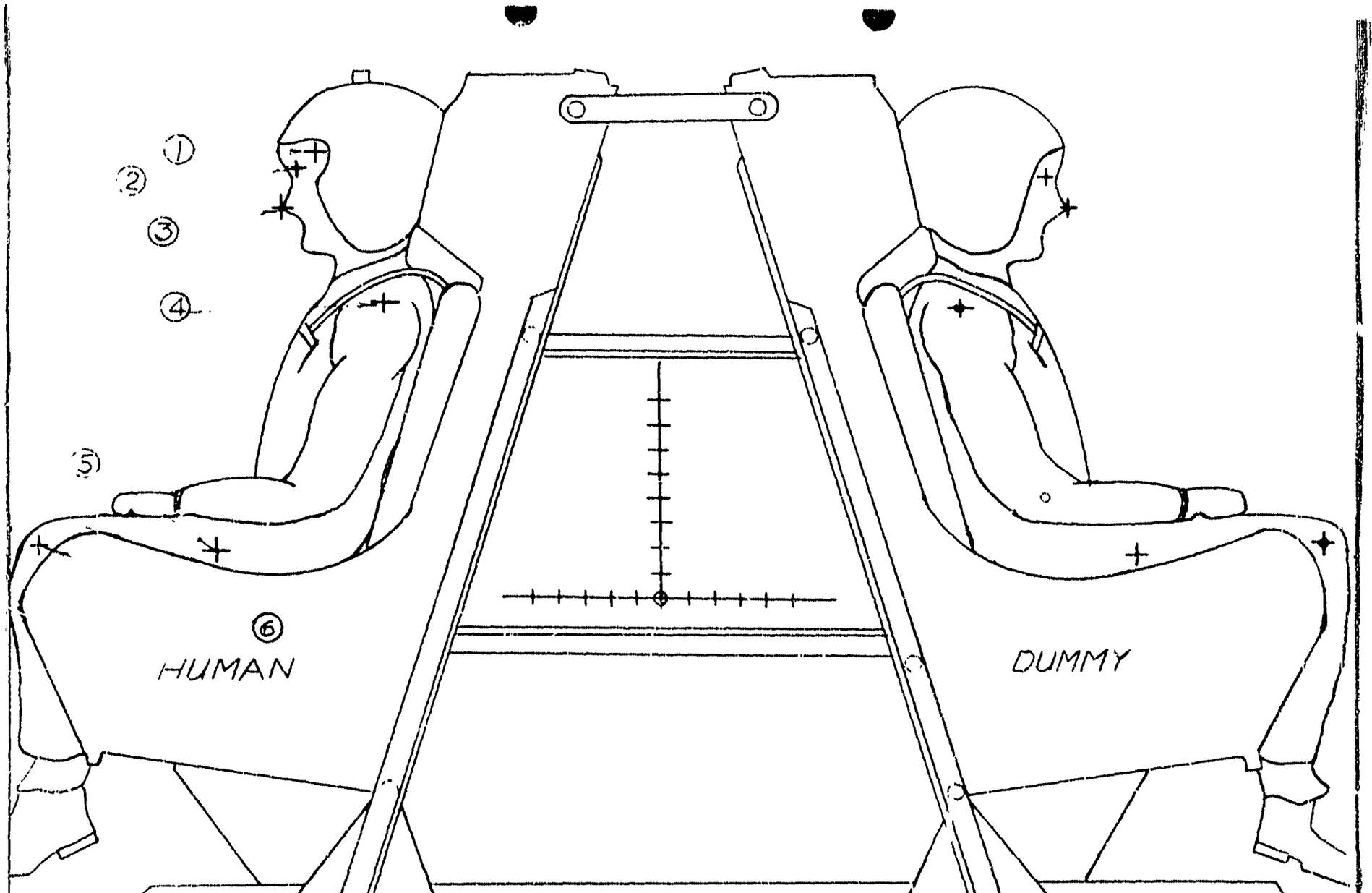


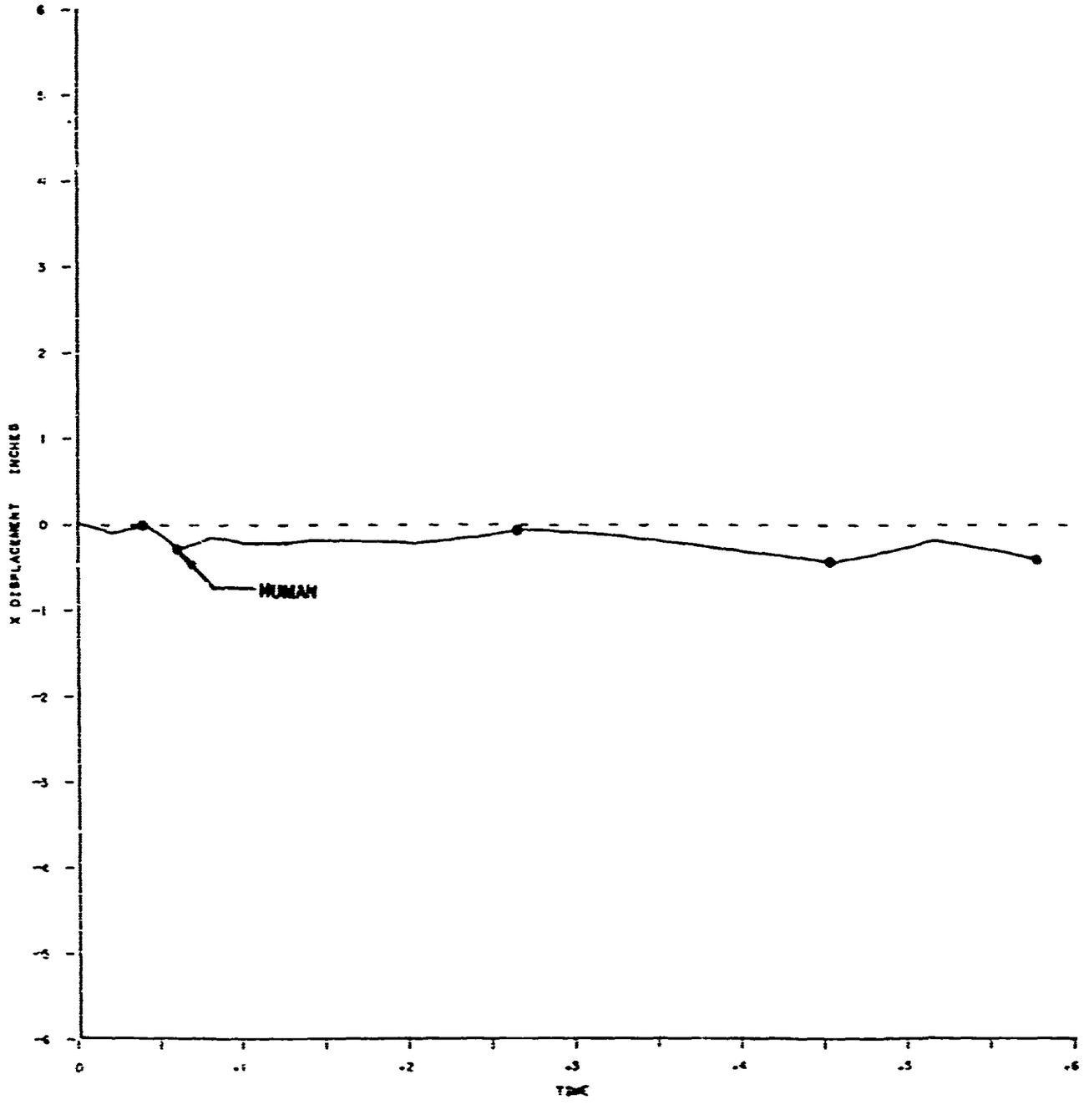
FIG. NO. 1 SET-UP FOR HUMAN-DUMMY TESTS

FIGURES 2 THRU 43

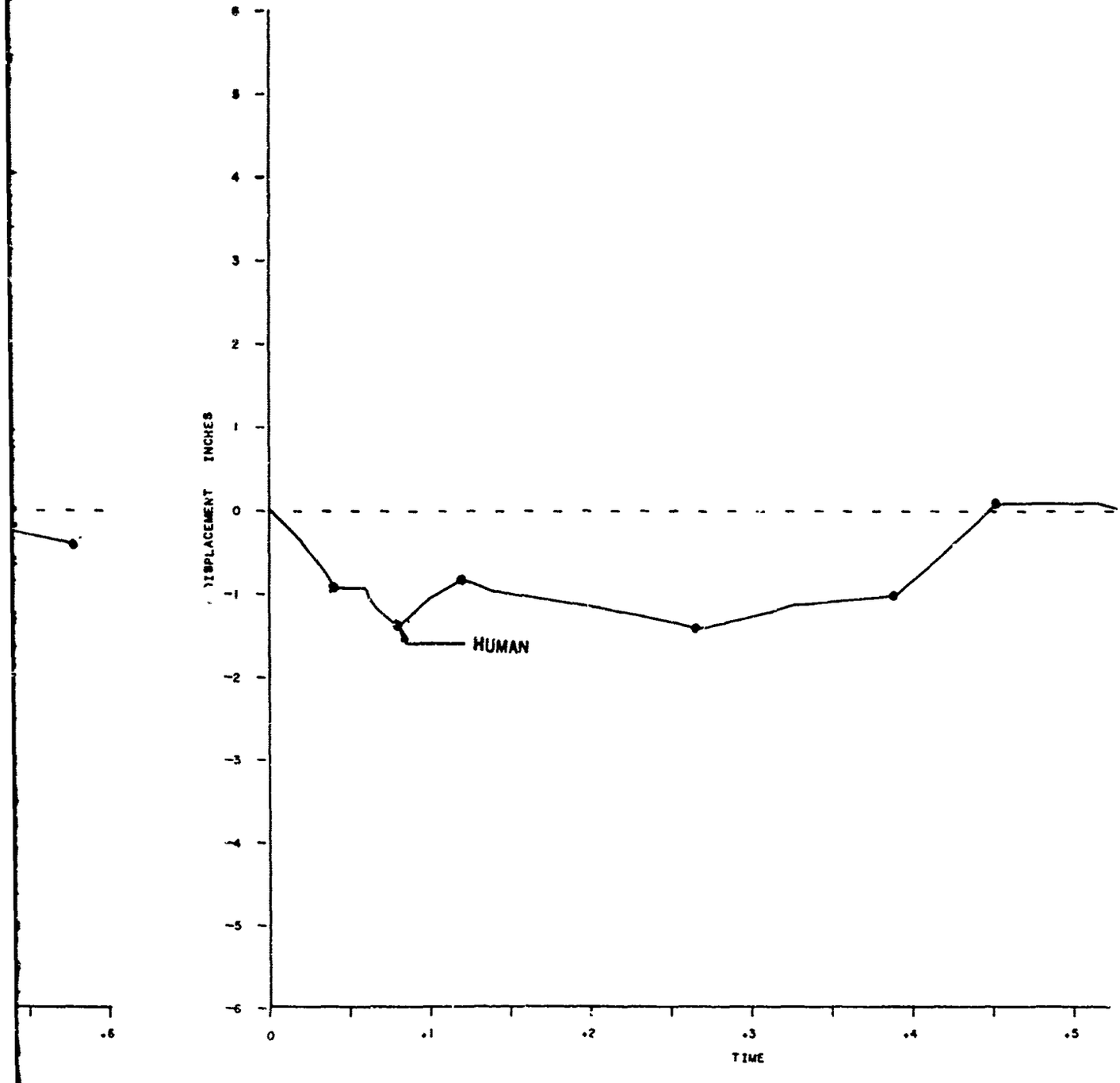
DATA PLOTS OF C. BROOKS AND 95 PERCENTILE DUMMY

TEST NO.	G LEVEL	IMPACT VELOCITY
34	4.9	44 FPS
39	9.0	33 FPS
40	10.0	33 FPS
60	8.4	33 FPS
61	8.1	44 FPS

SUBJECTS - BROOKS
TEMPLE POINT - T



ROOKS & 95 %TILE DUMMY
NT - TEST NO. 34 - 4.9 G



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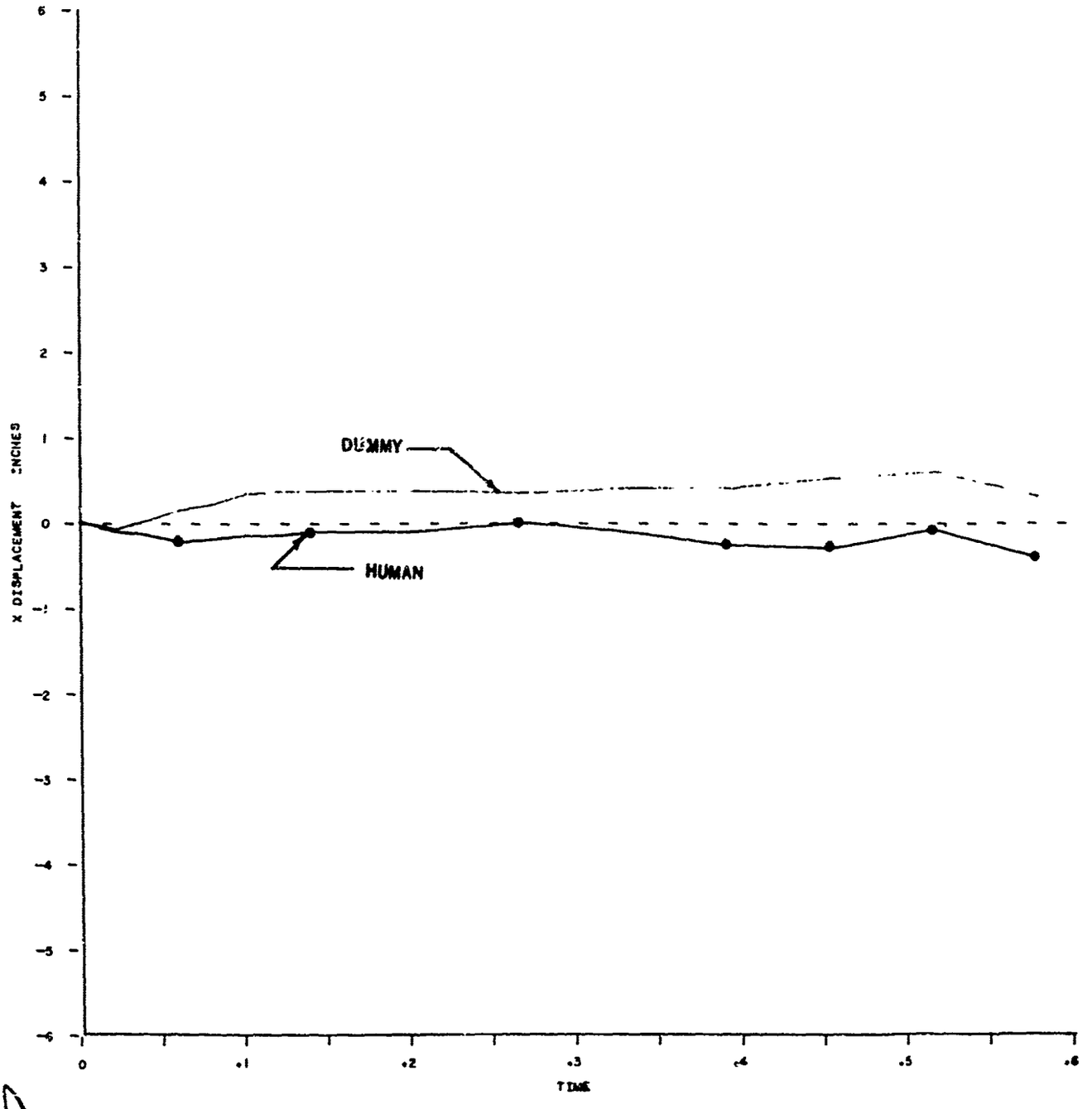
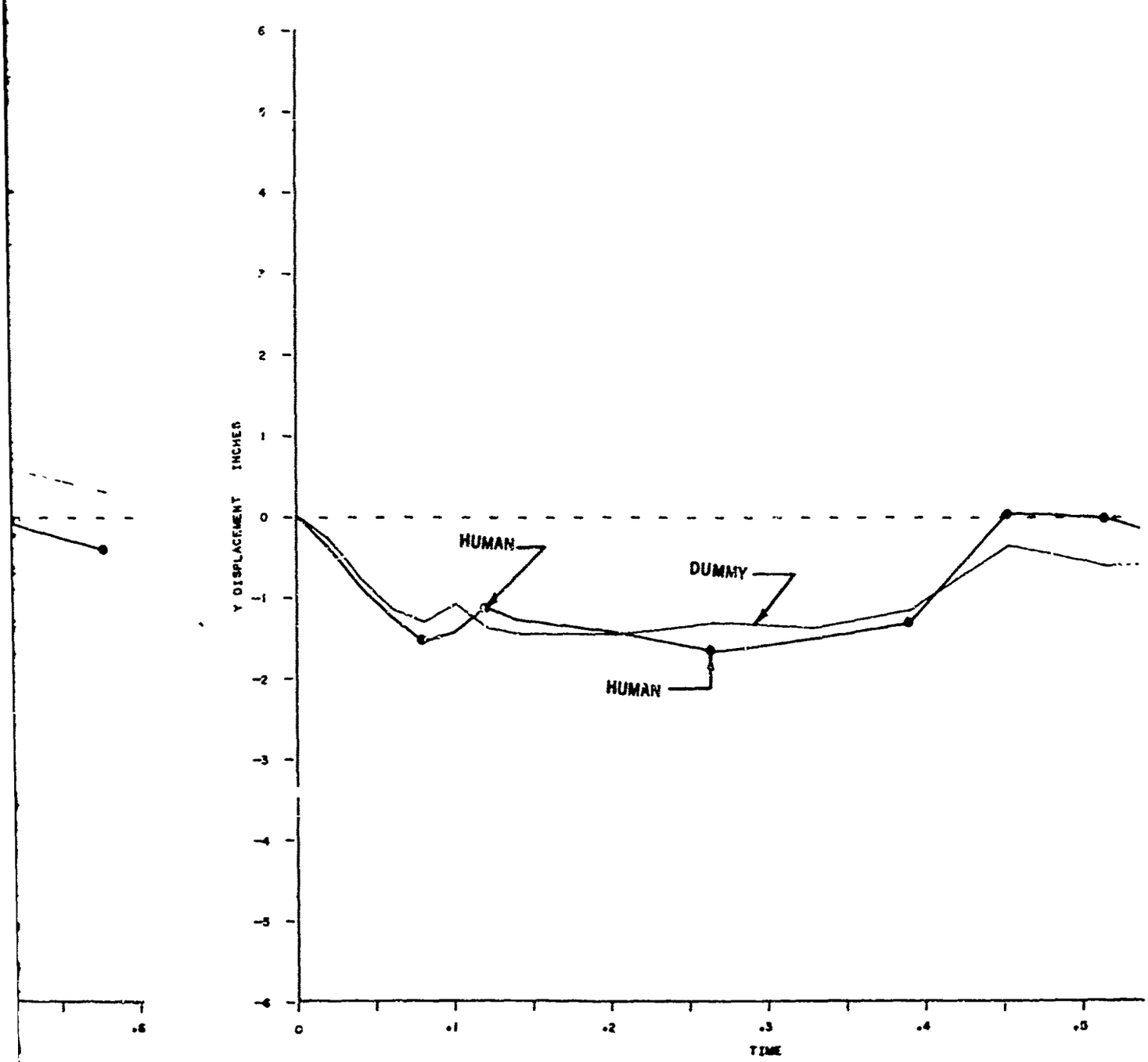
SUBJECTS - BROOKS
EYE POINT - TEST

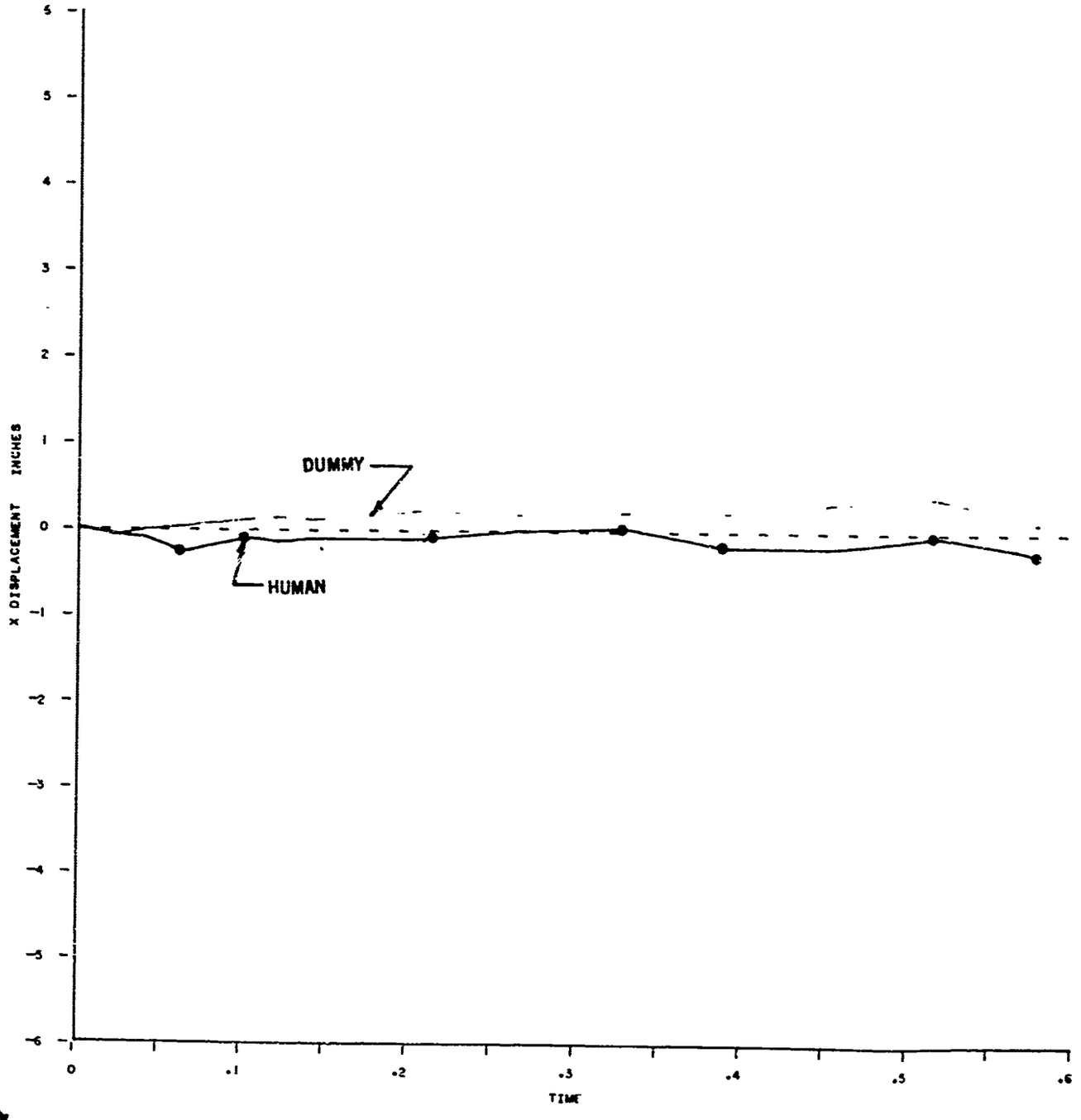


- BROOKS & 95 %TILE DUMMY
INT - TEST NO. 34 - 4.9 G



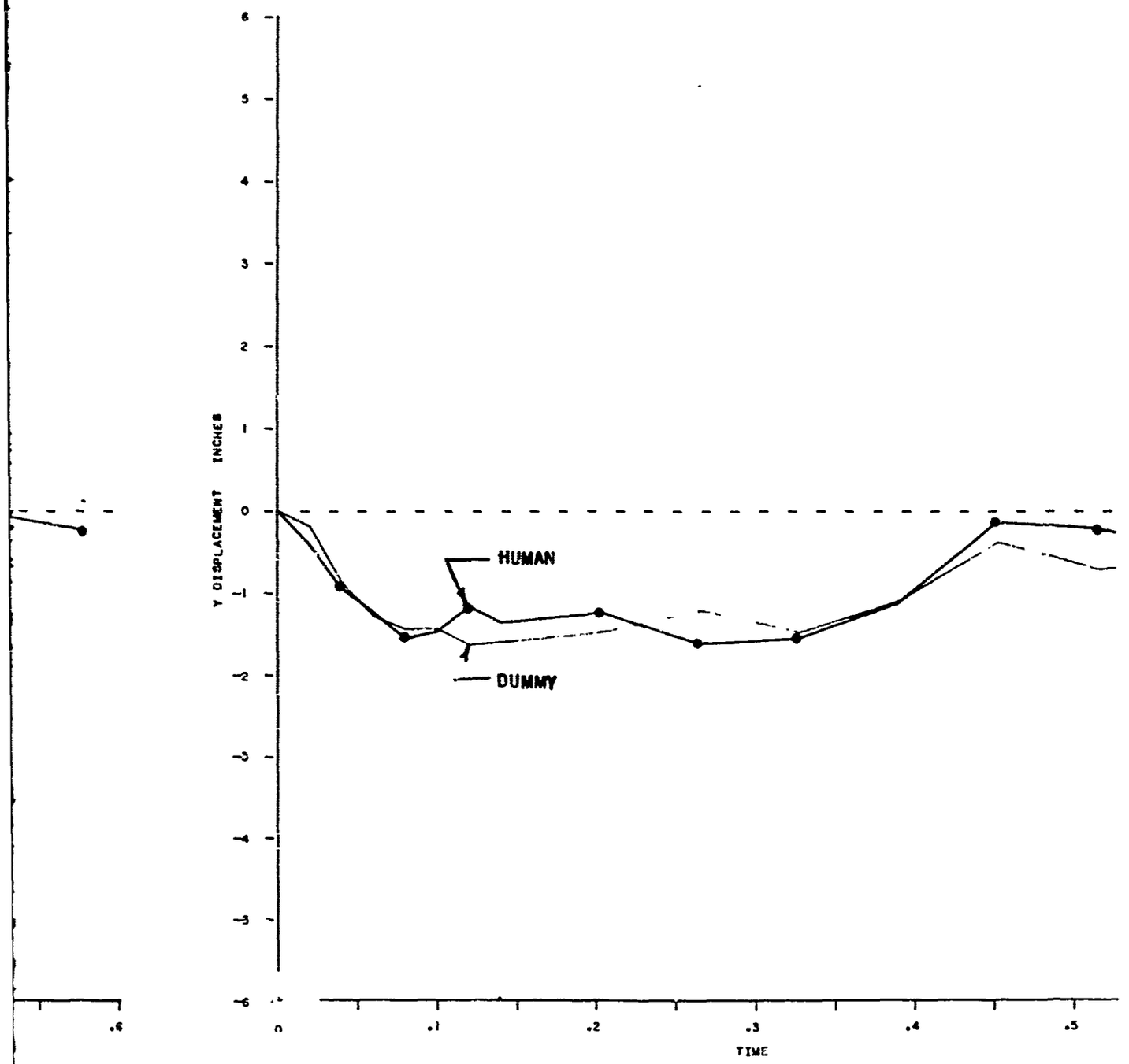
B

BROOKS & 95 %T
NOSE POINT - TEST



Y DISPLACEMENT INCHES

& 95 %TILE DUMMY
- TEST NO. 34 - 4.9 G



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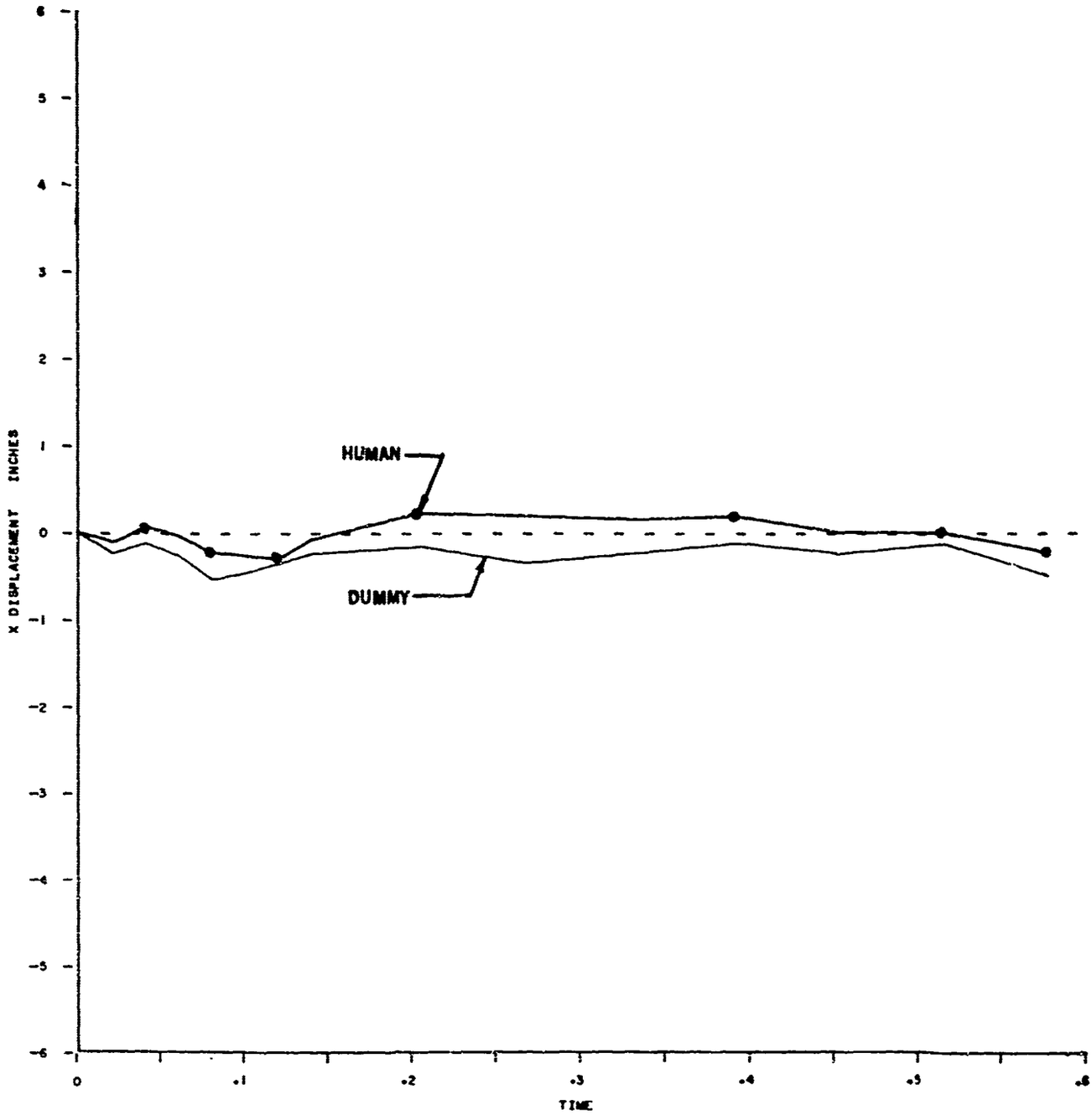
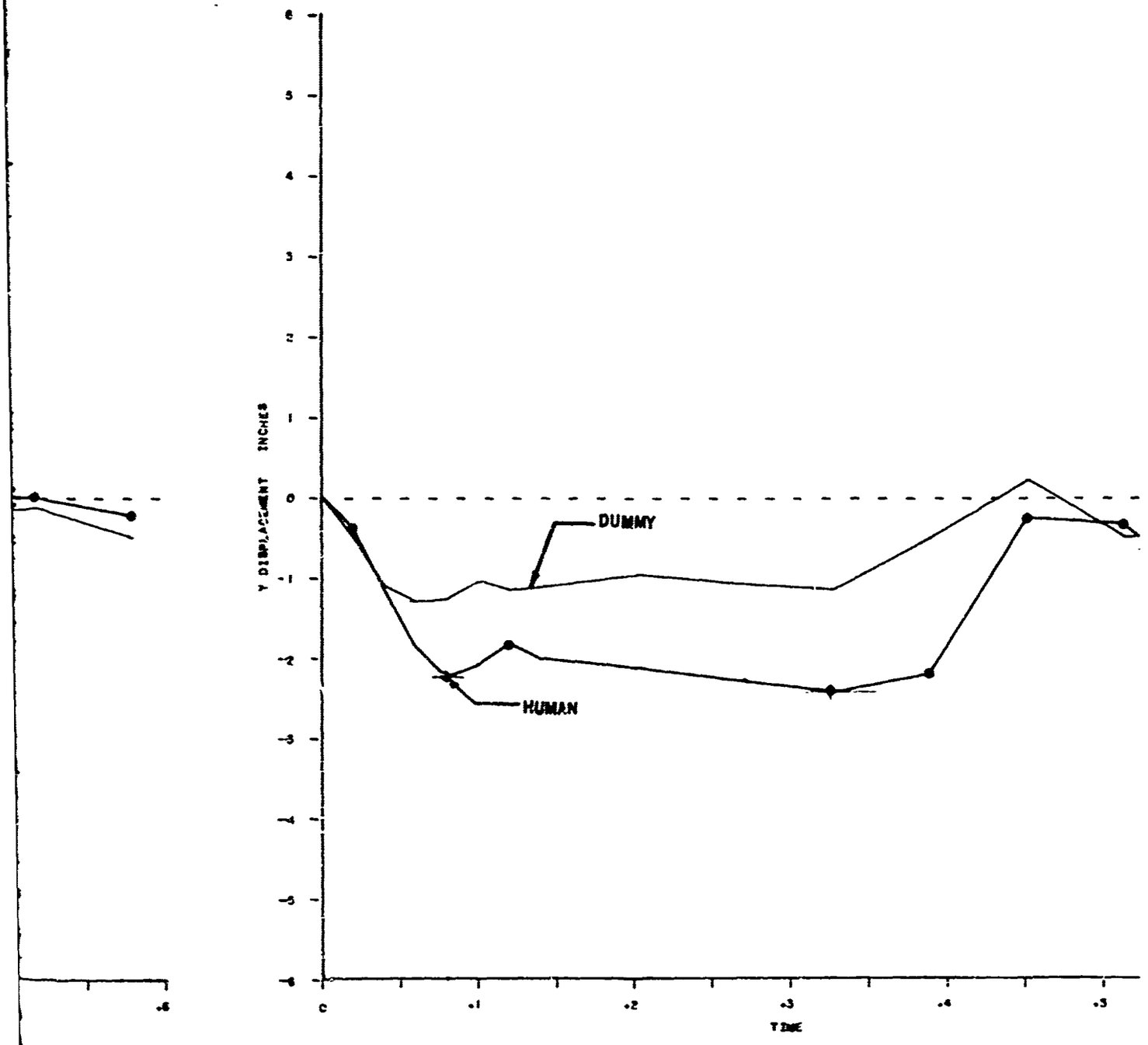
SUBJECTS BROO
SHOULDER POIN



A

ECTS BROOKS & 95 %TILE DUMMY
LDER POINT - TEST NO. 34 - 4.9 G



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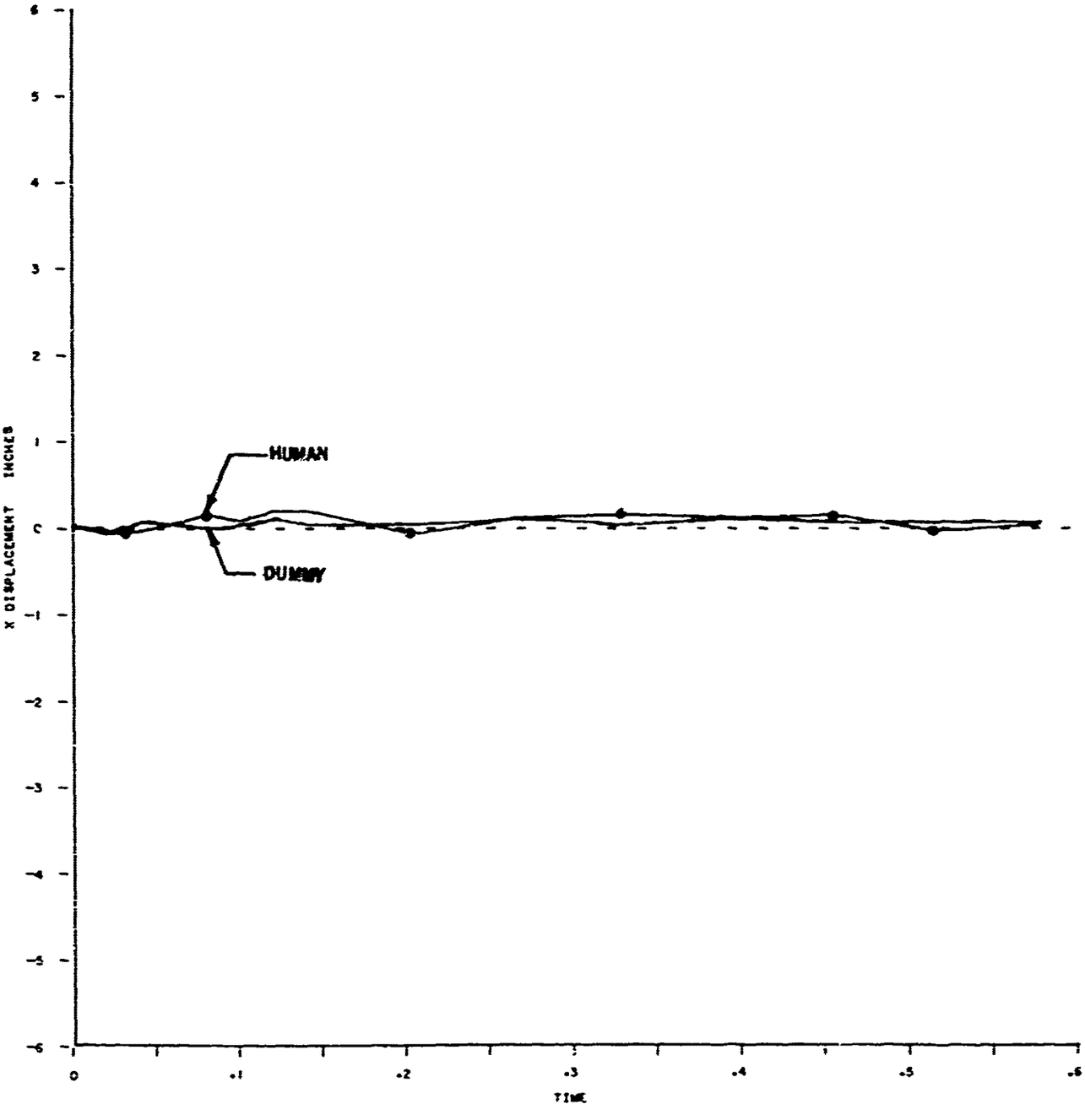
SUBJECTS - BROOKS
THIGH POINT - TES



BROOKS & 95 %TILE DUMMY
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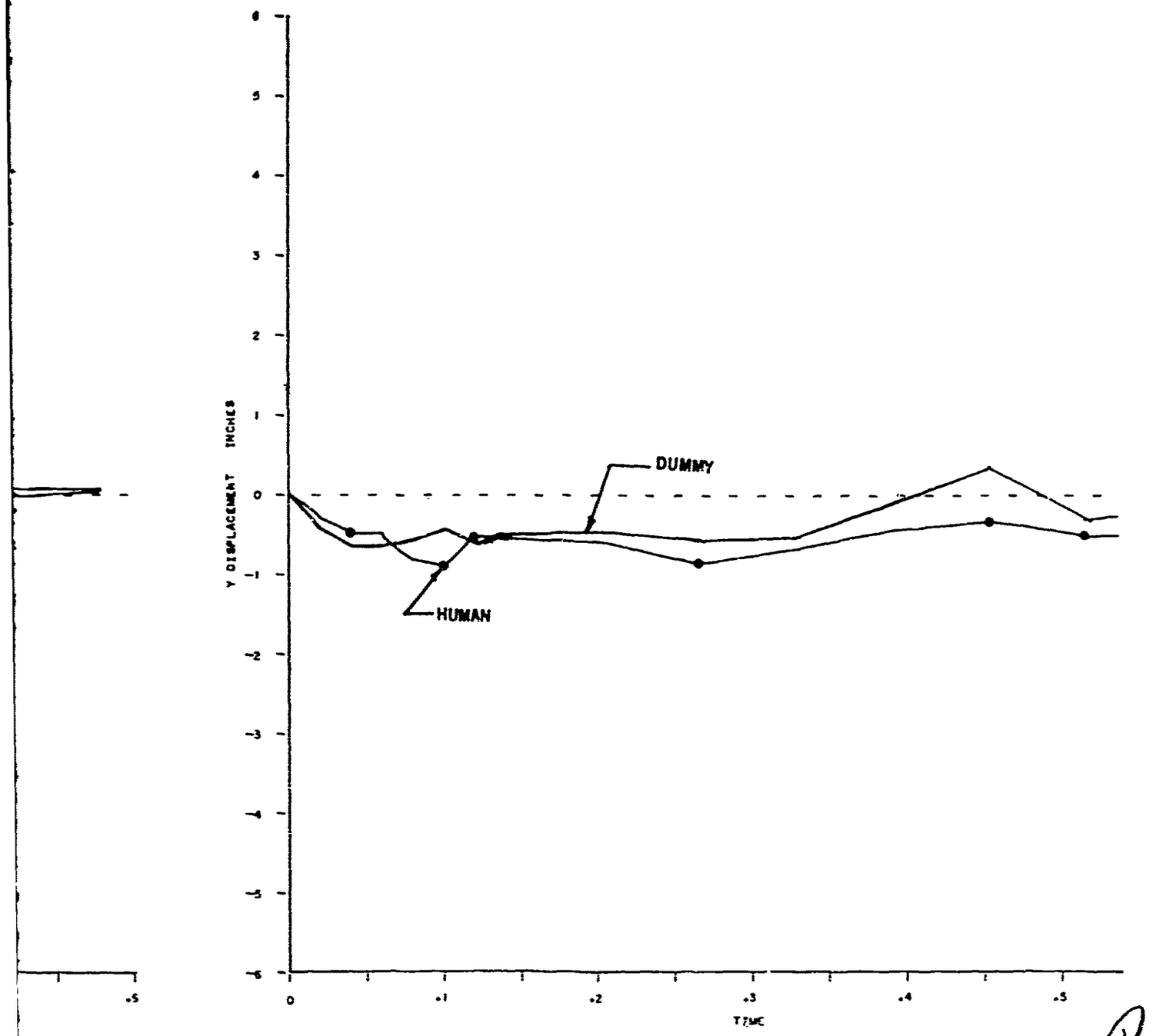
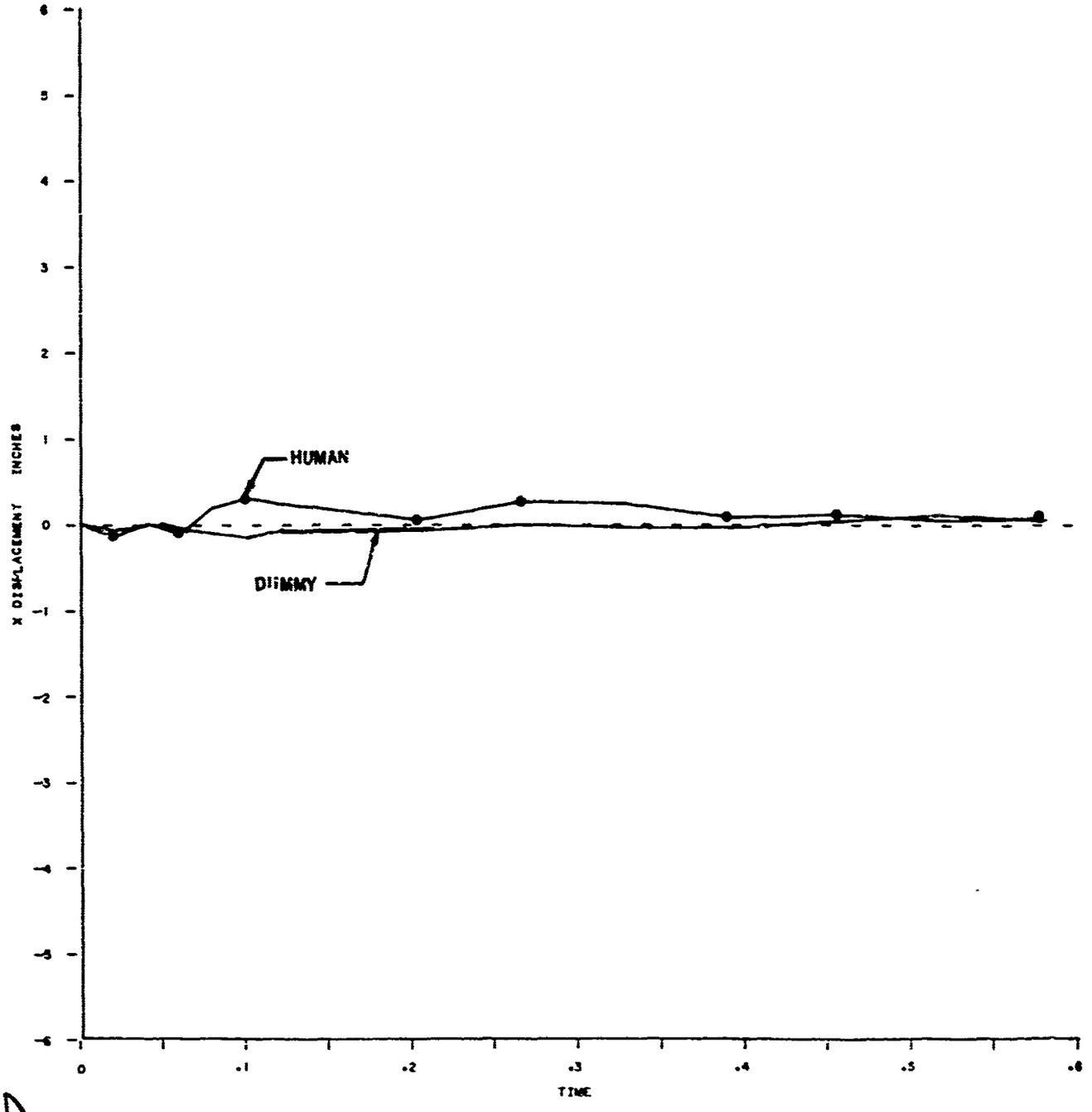
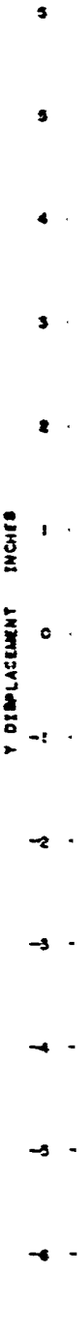


B

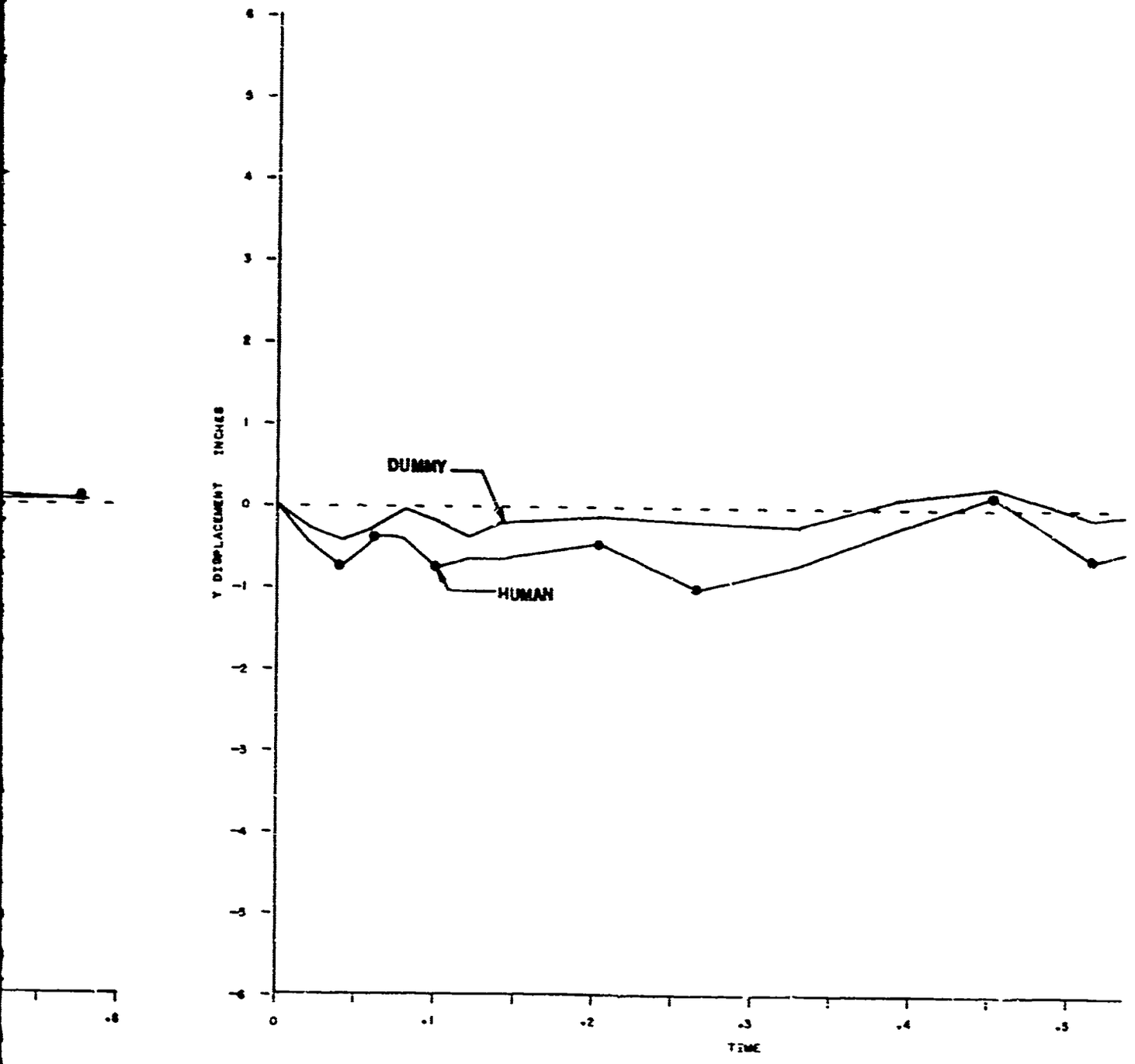
SUBJECTS - BROOKS & 95
KNEE POINT - TEST N(





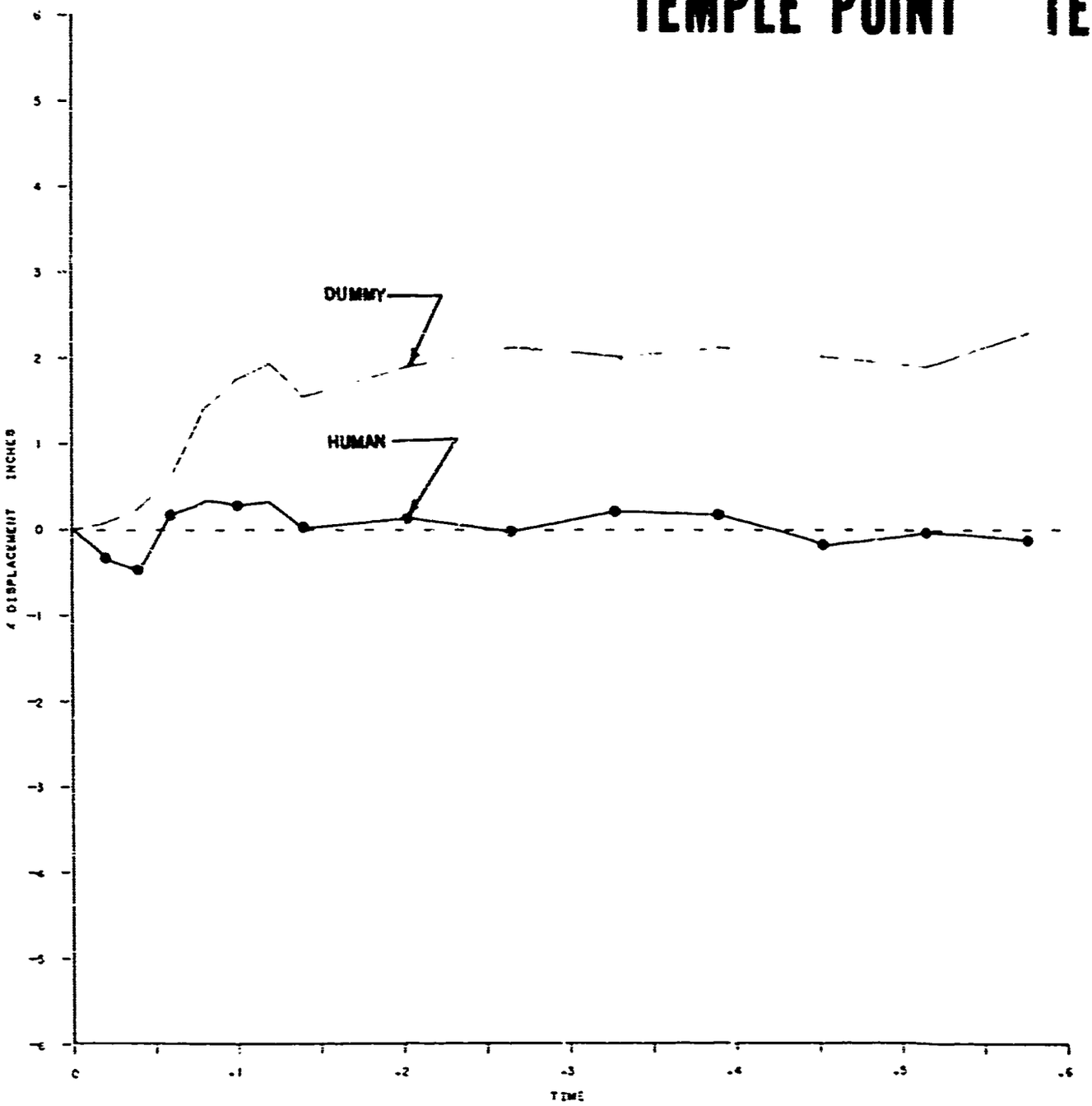
A

ROOKS & 95 %TILE DUMMY
T - TEST NO 34 - 4.9 G



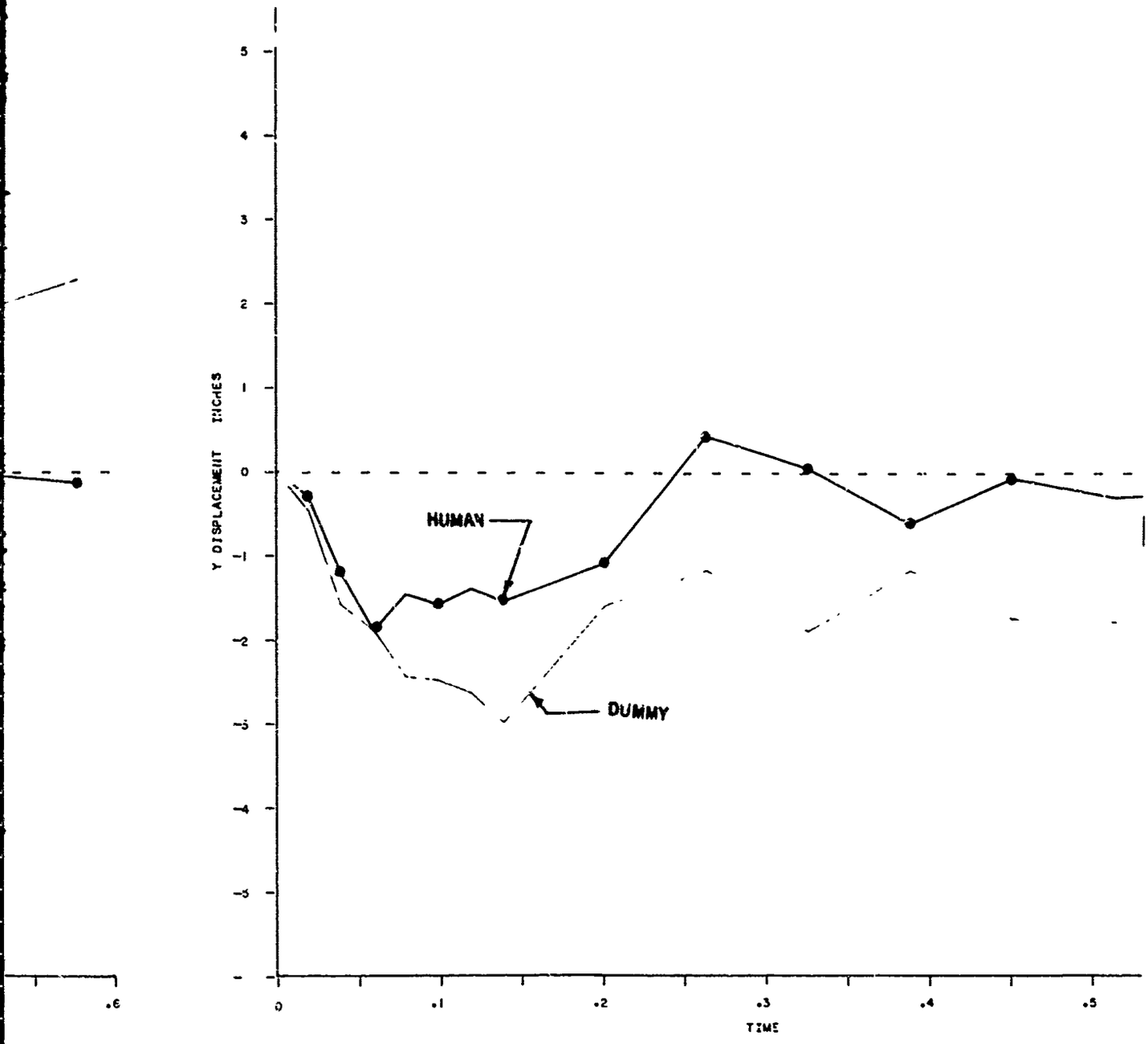
B

SUBJECTS - BROOKS & 9
TEMPLE POINT TEST



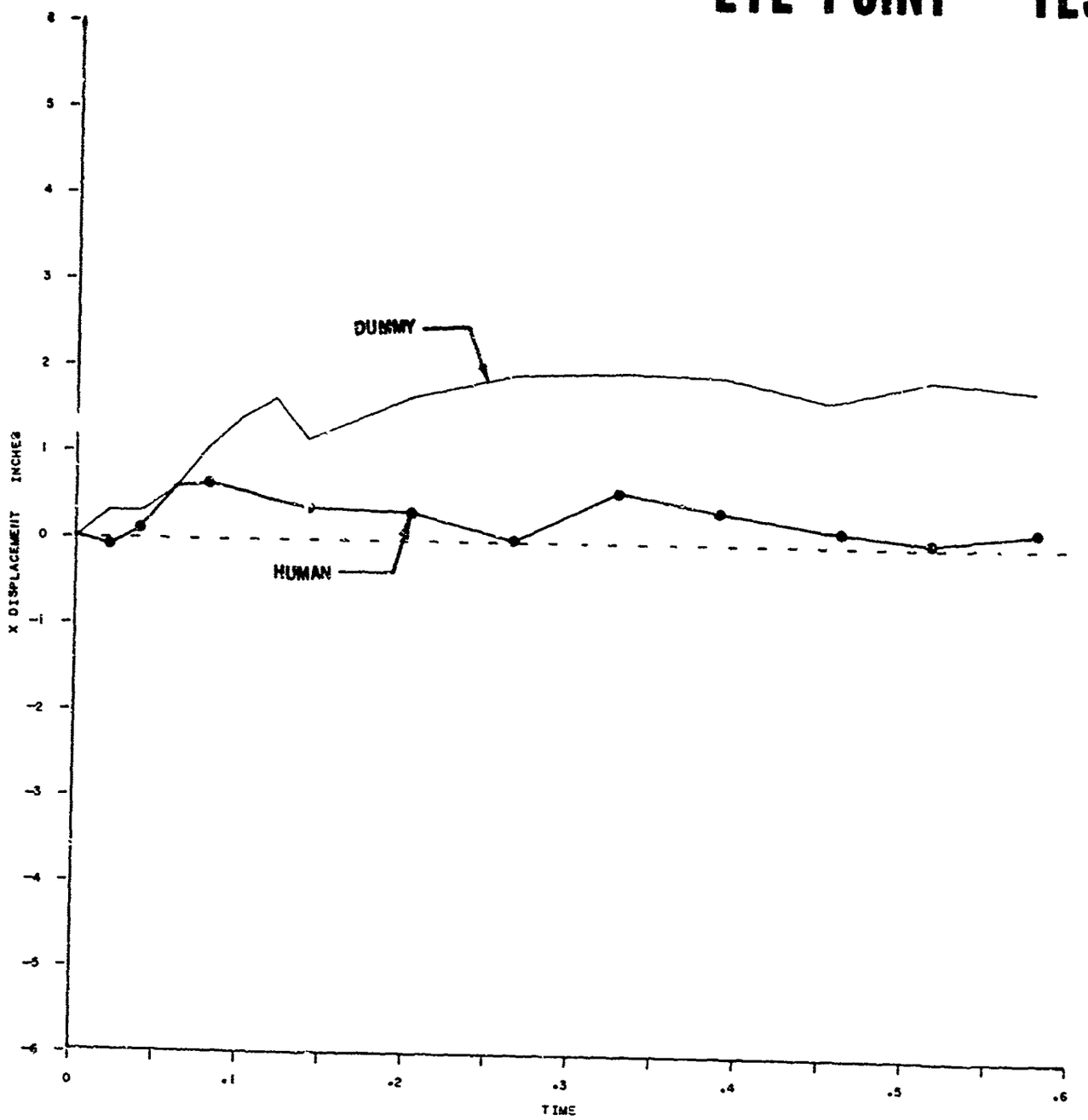
A

OOKS & 95 %TILE DUMMY
TEST NO. 61 8.4 G

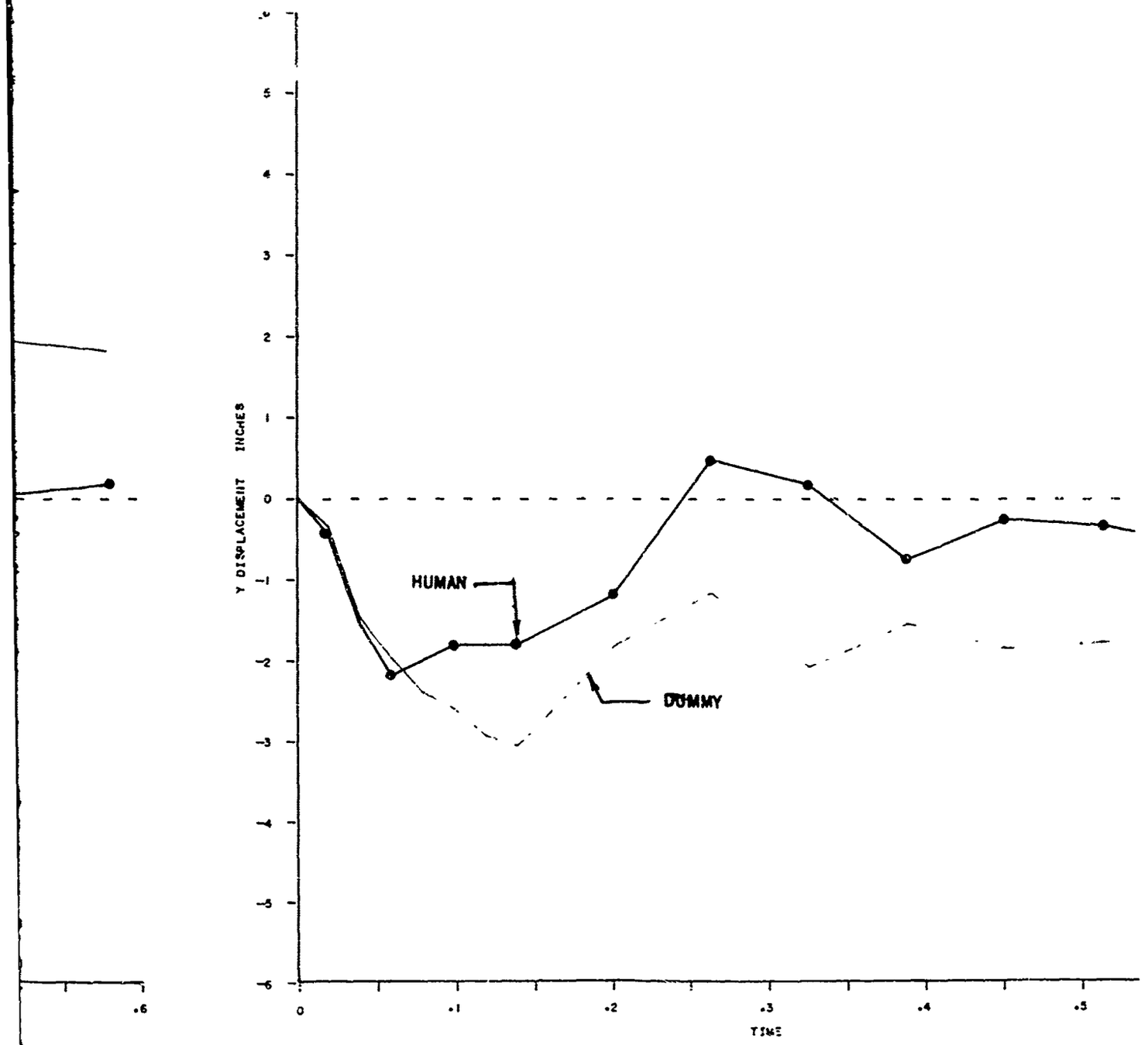


B

SUBJECTS - BROOKS &
EYE POINT TEST

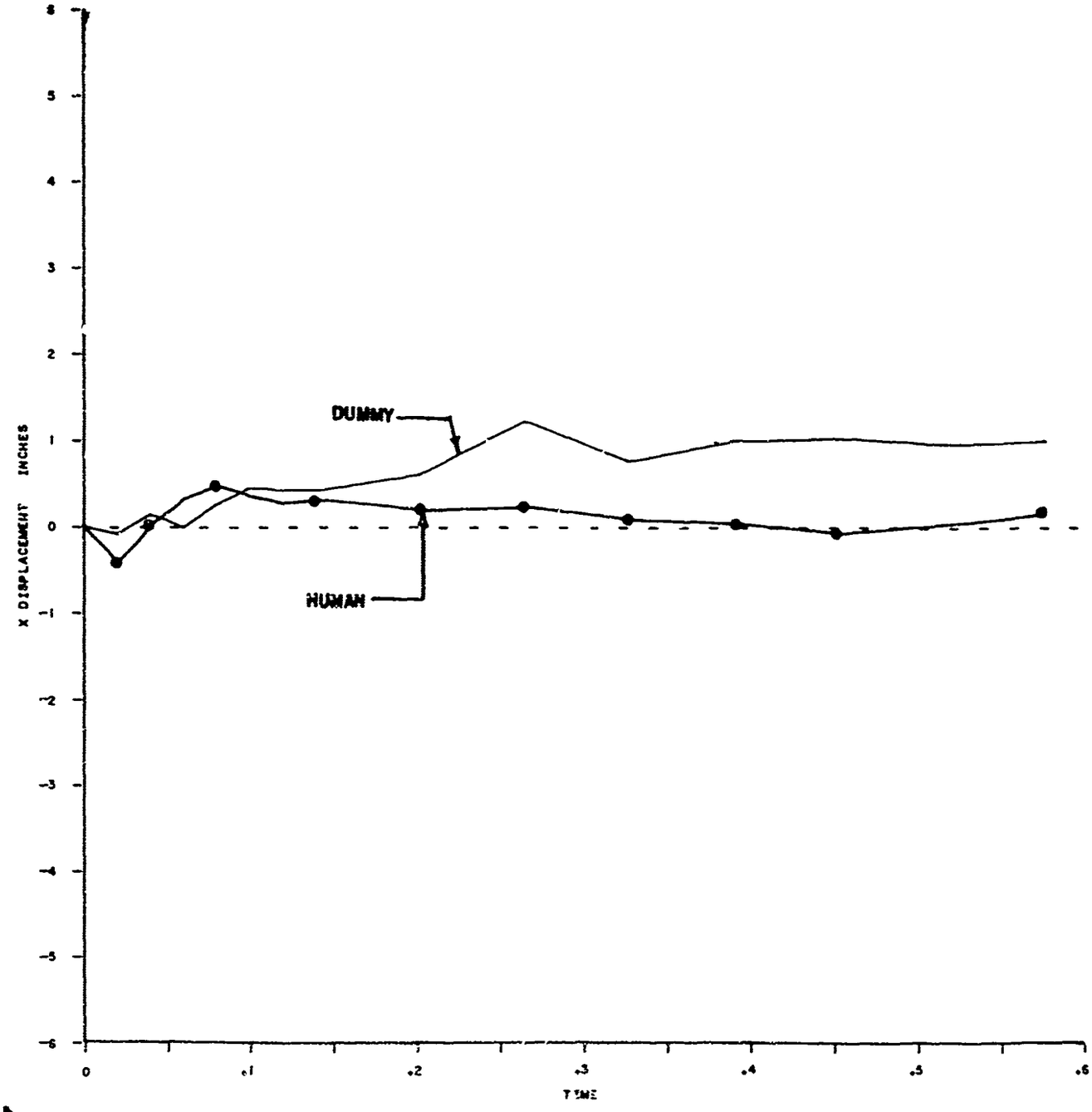


ROOKS & 95 %TILE DUMMY
TEST NO. 61 8.4 G



B

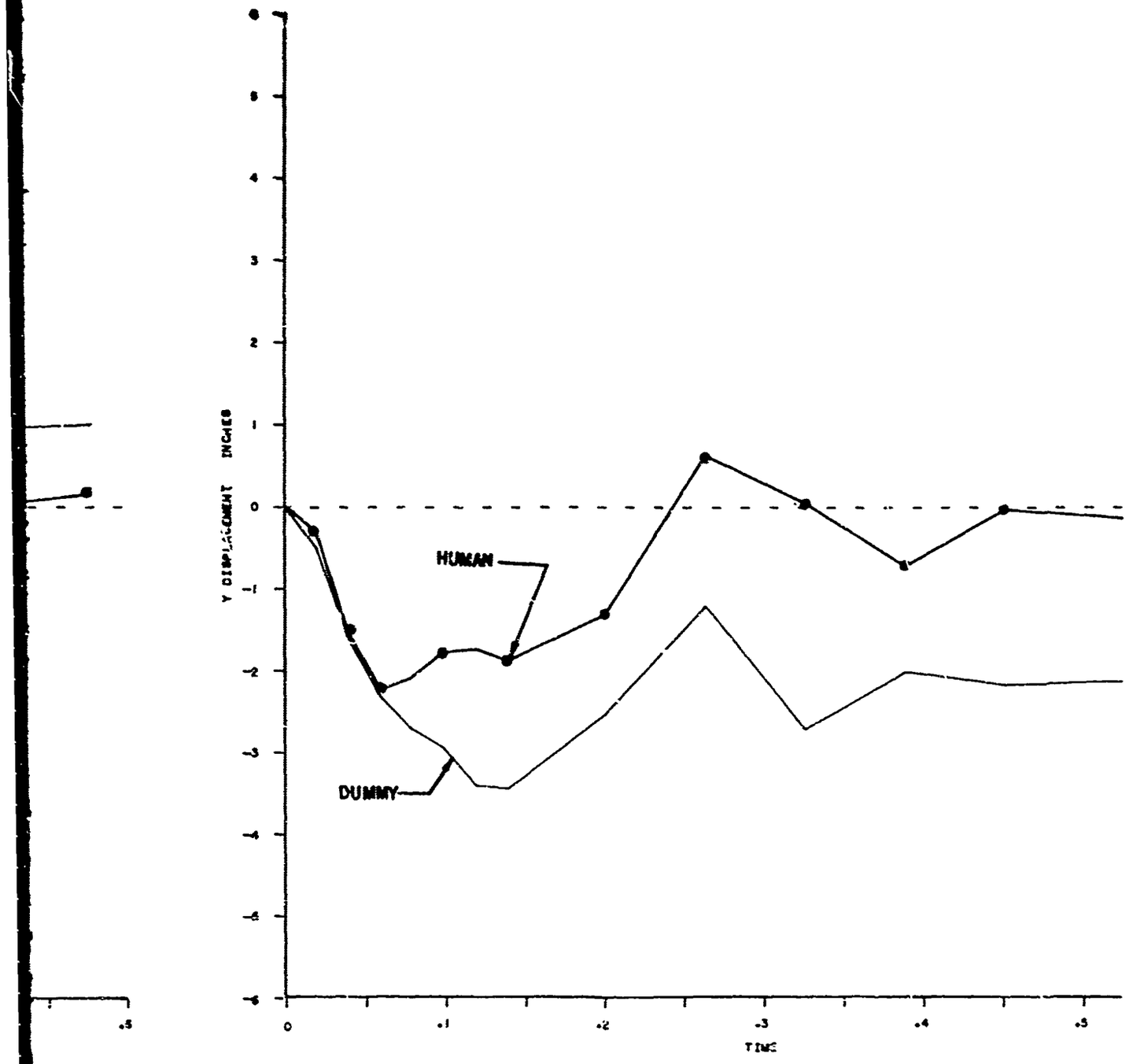
SUBJECTS - BROOKS &
NOSE POINT TEST



A

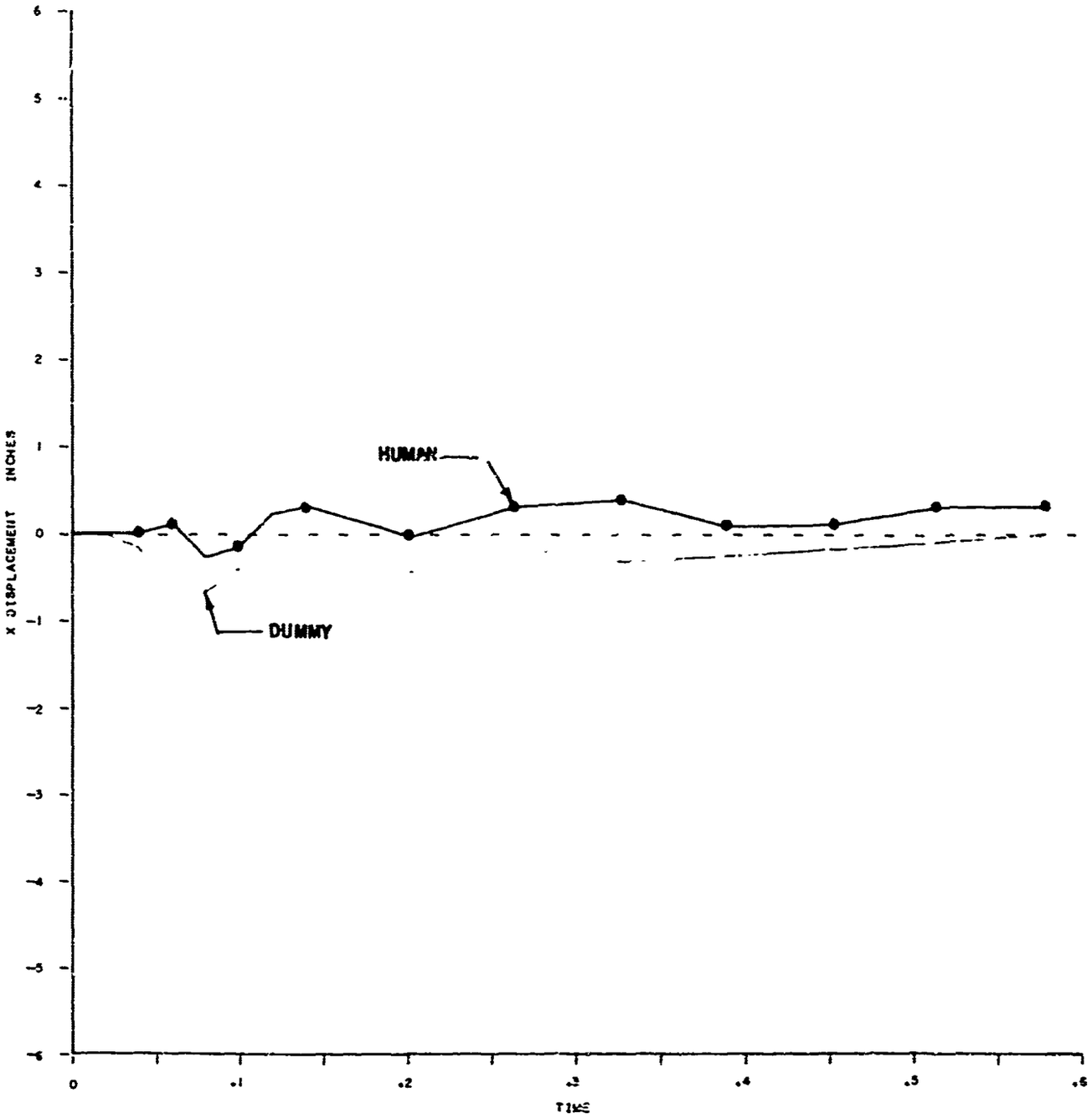
BROOKS & 95 %TILE DUMMY

T TEST NO. 61 8.4 G

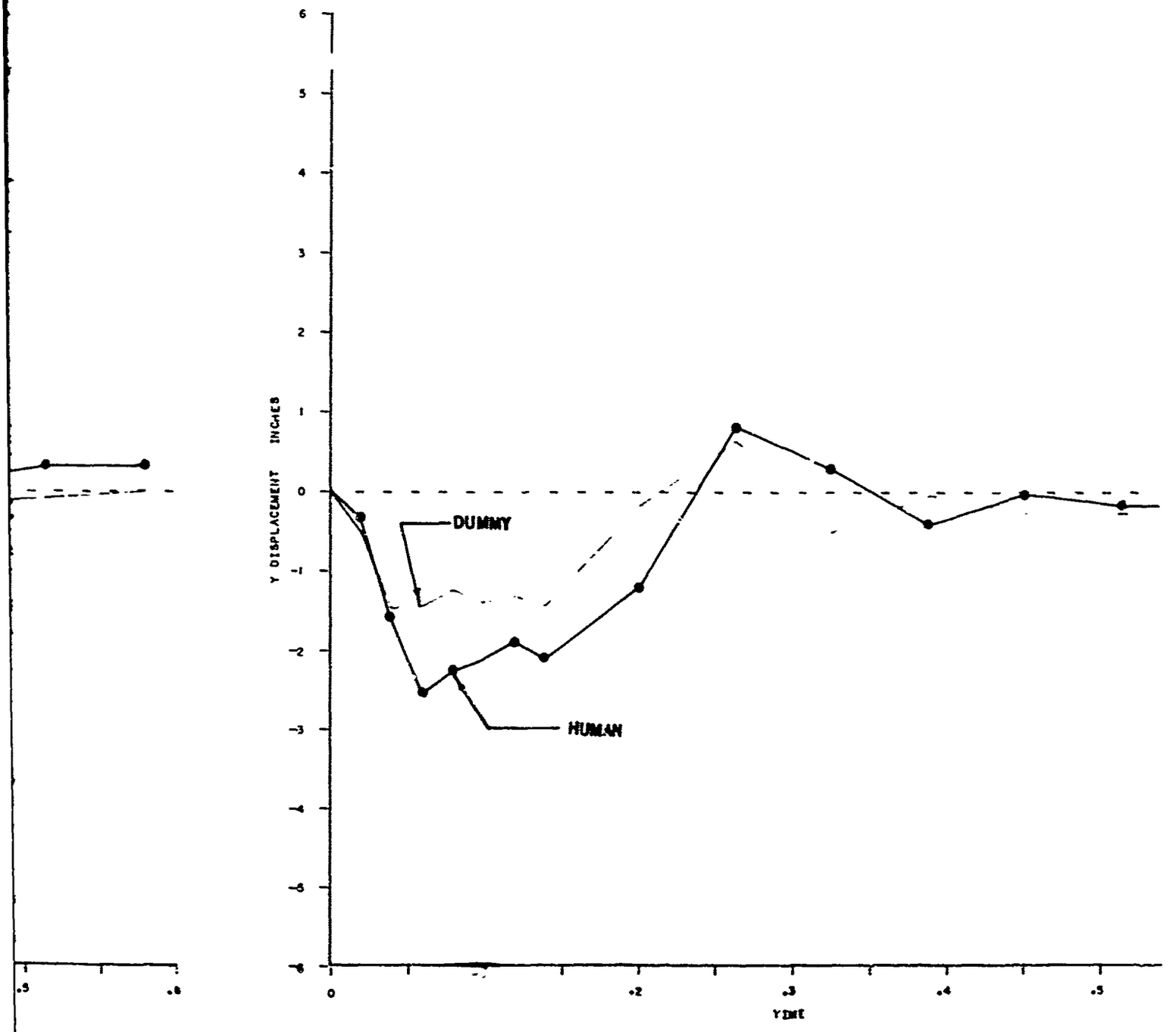


B

SUBJECTS - BROOKS &
SHOULDER POINT - TES

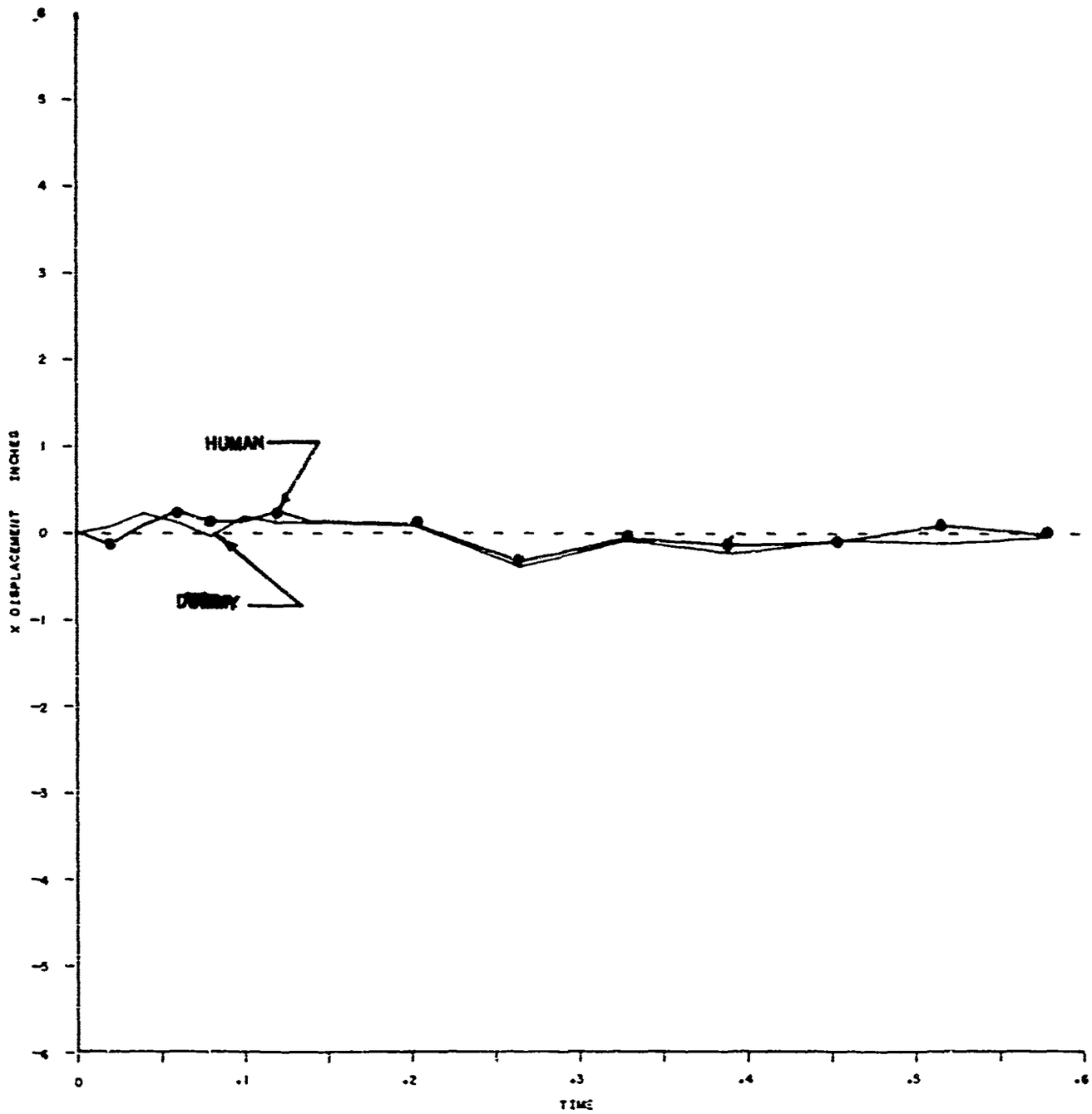


BROOKS & 95 %TILE DUMMY
POINT - TEST NO. 61 8.4 G

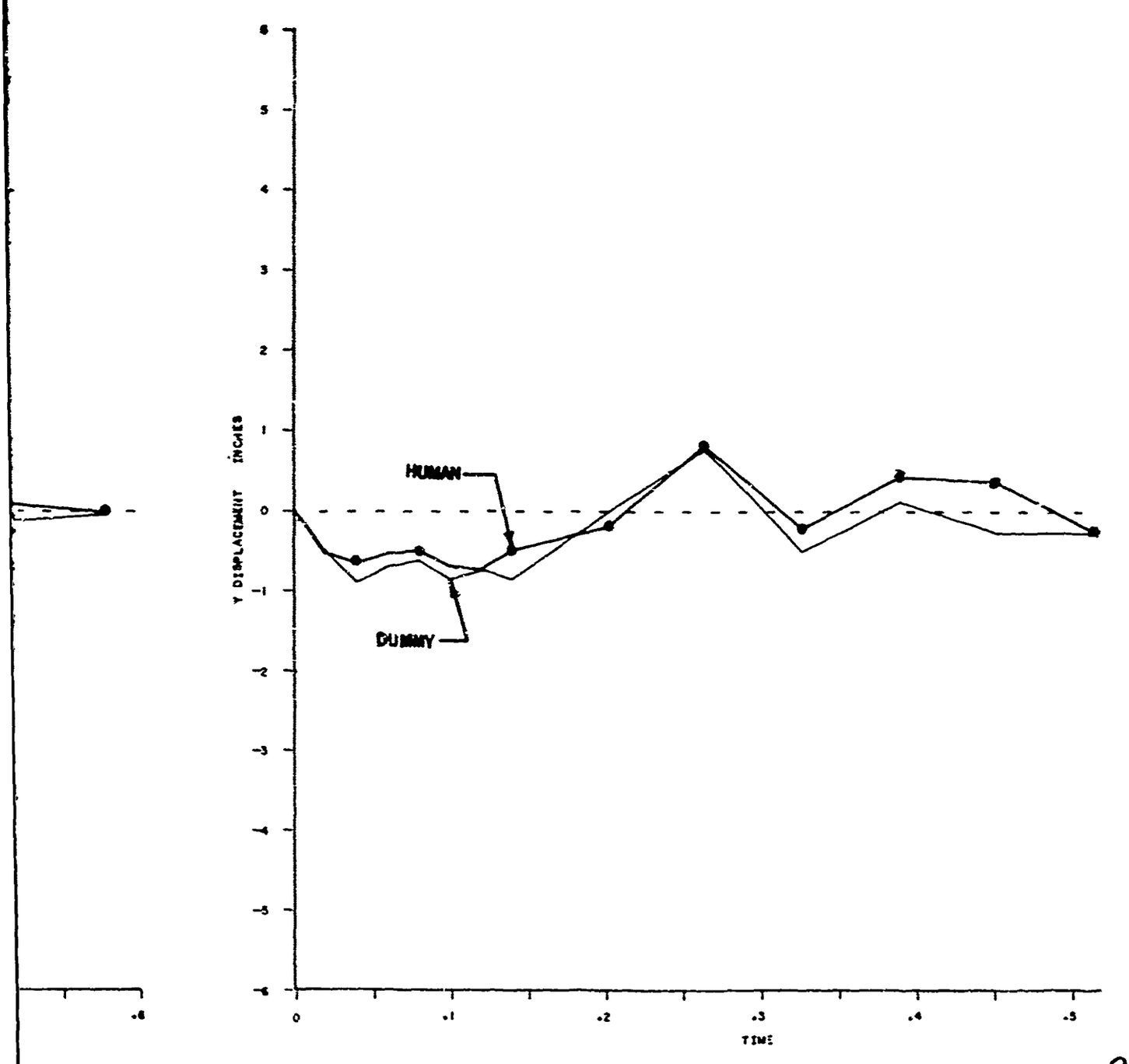


B

SUBJECTS - BROOKS
THIGH POINT - TI

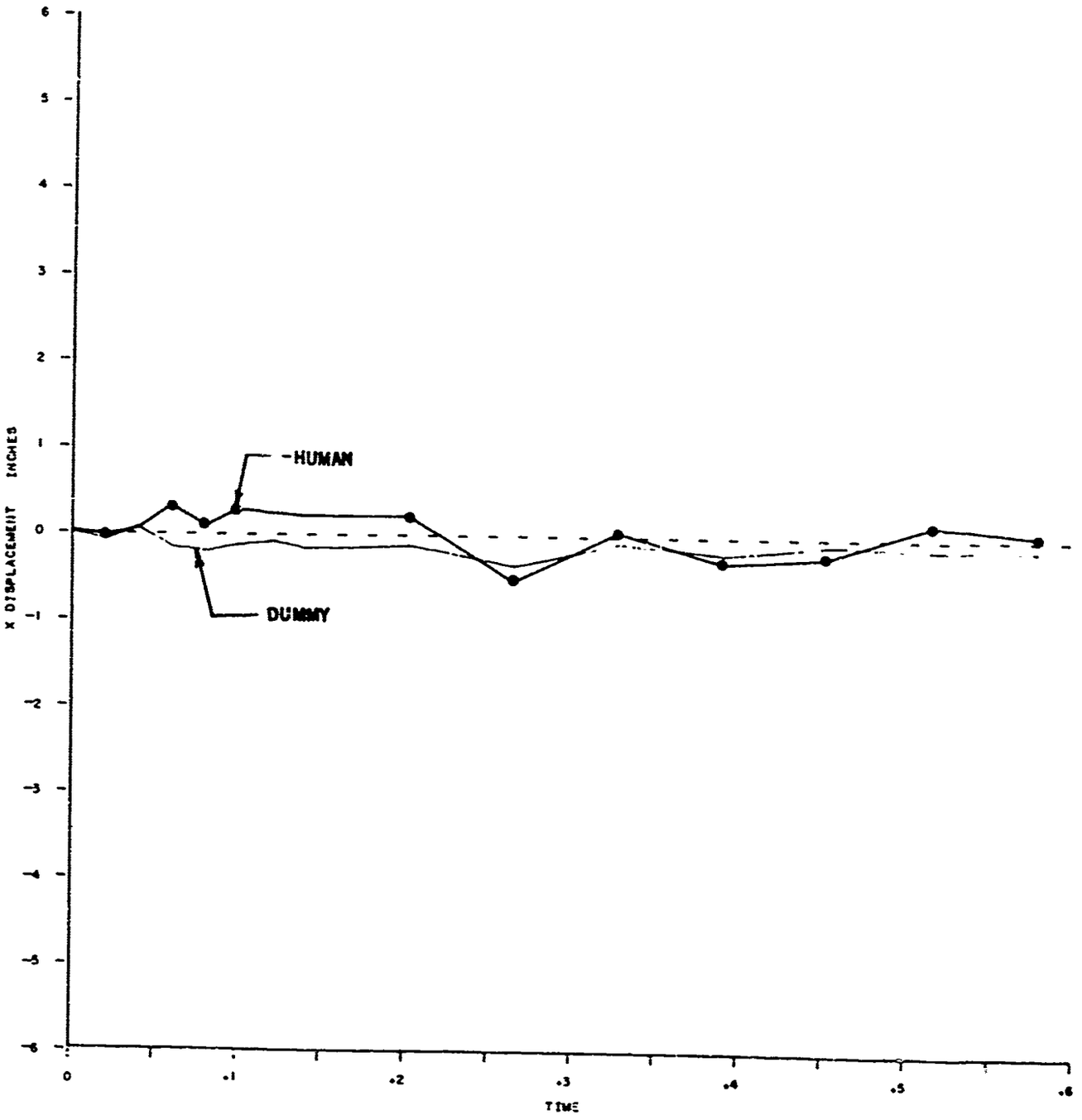


BROOKS & 95 %TILE DUMMY
INT - TEST NO. 61 - 8.4 G

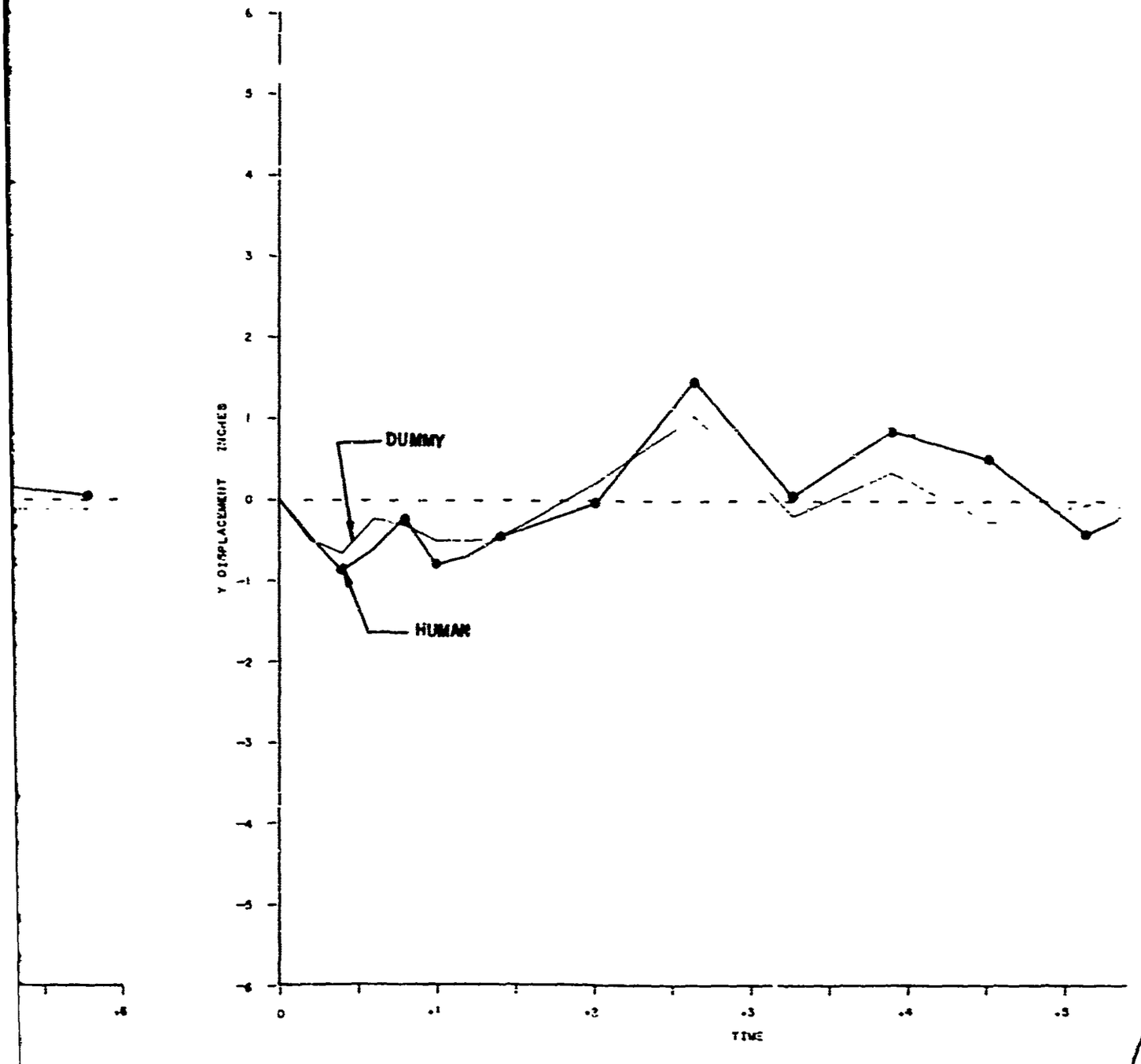


B

SUBJECTS - BROOKS &
KNEE POINT - TES

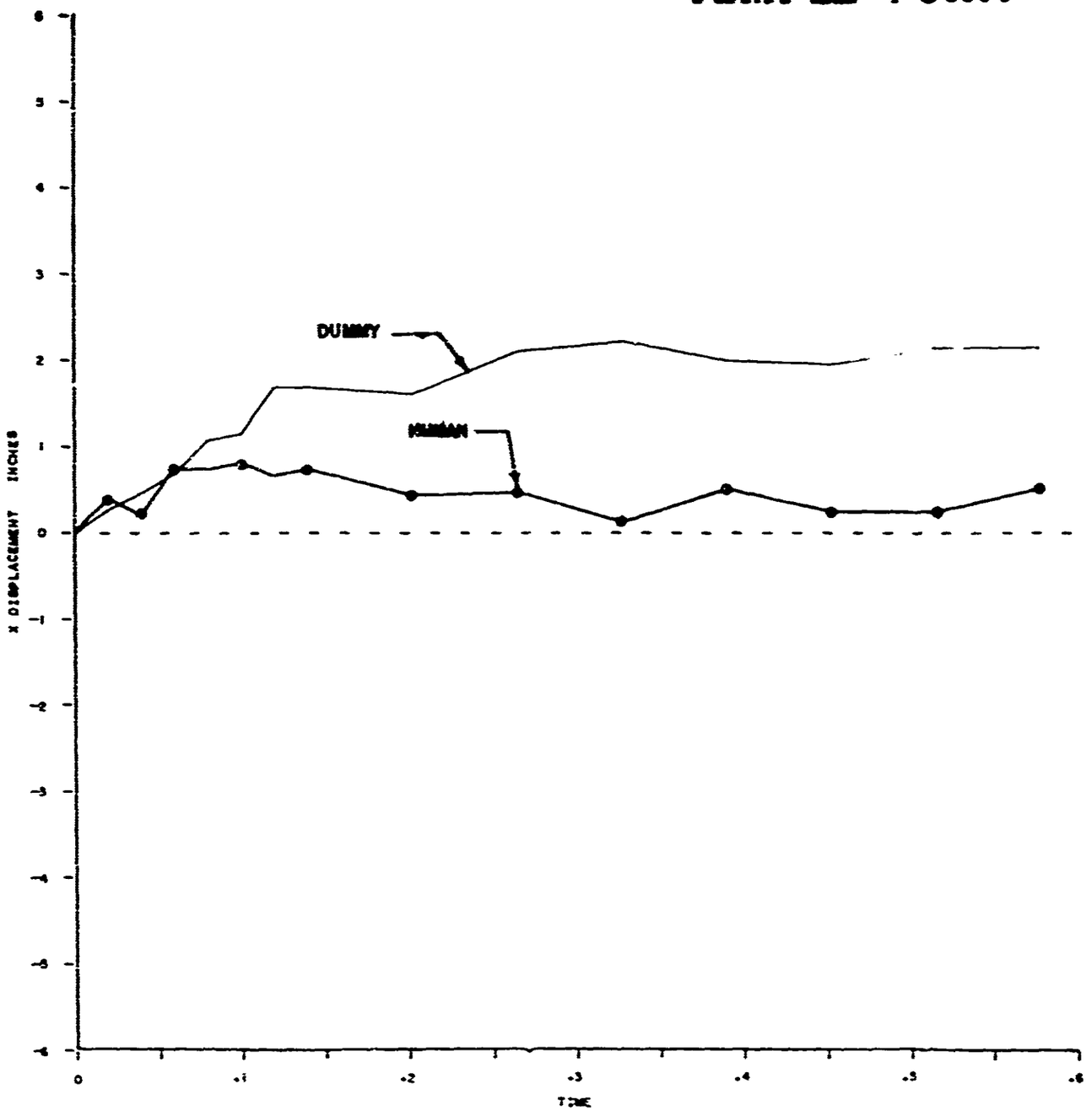


BROOKS & 95 %TILE DUMMY
JINT - TEST NO. 61 - 8.4 G



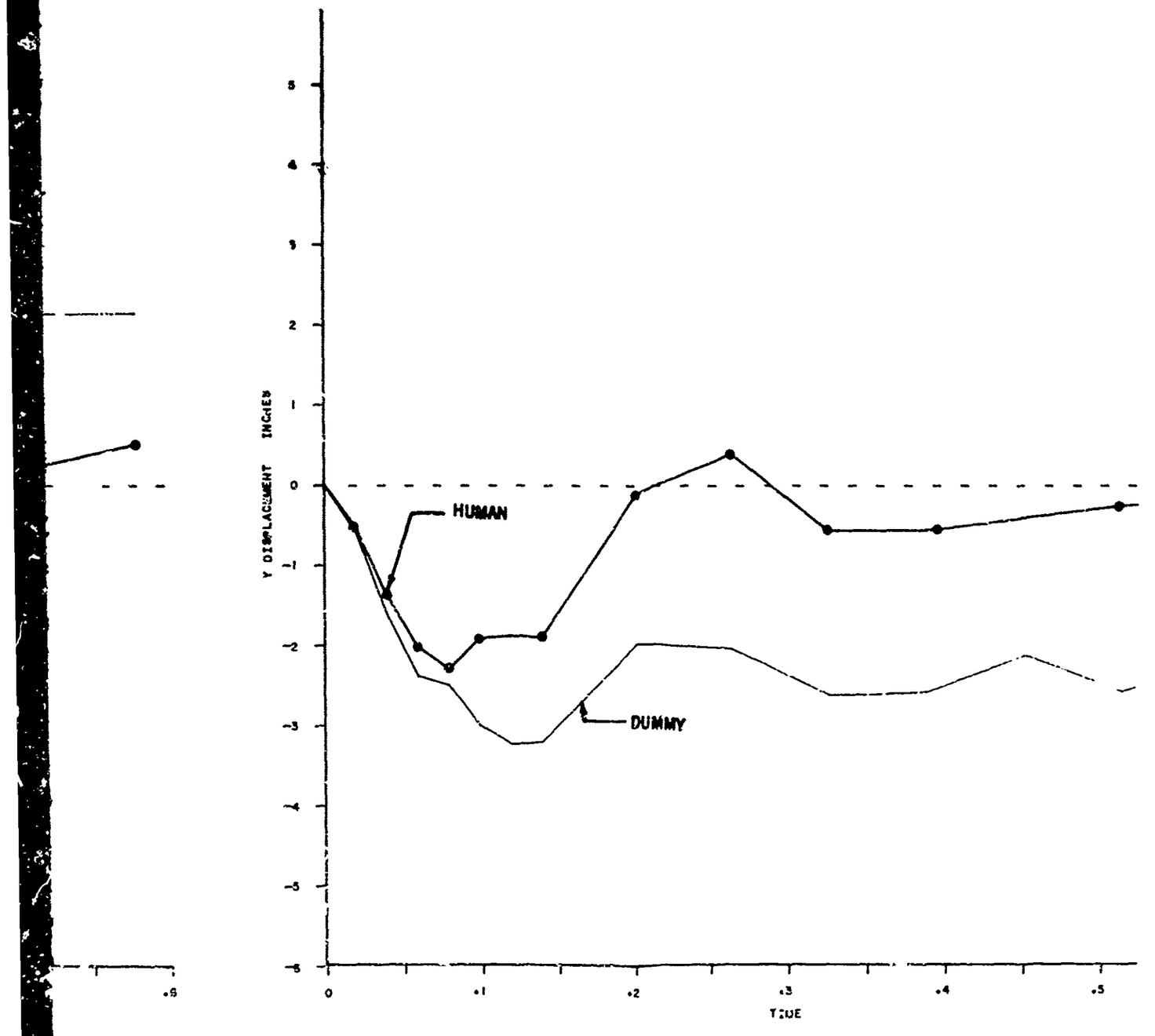
B

SUBJECTS - BROOKS
TEMPLE POINT - TI



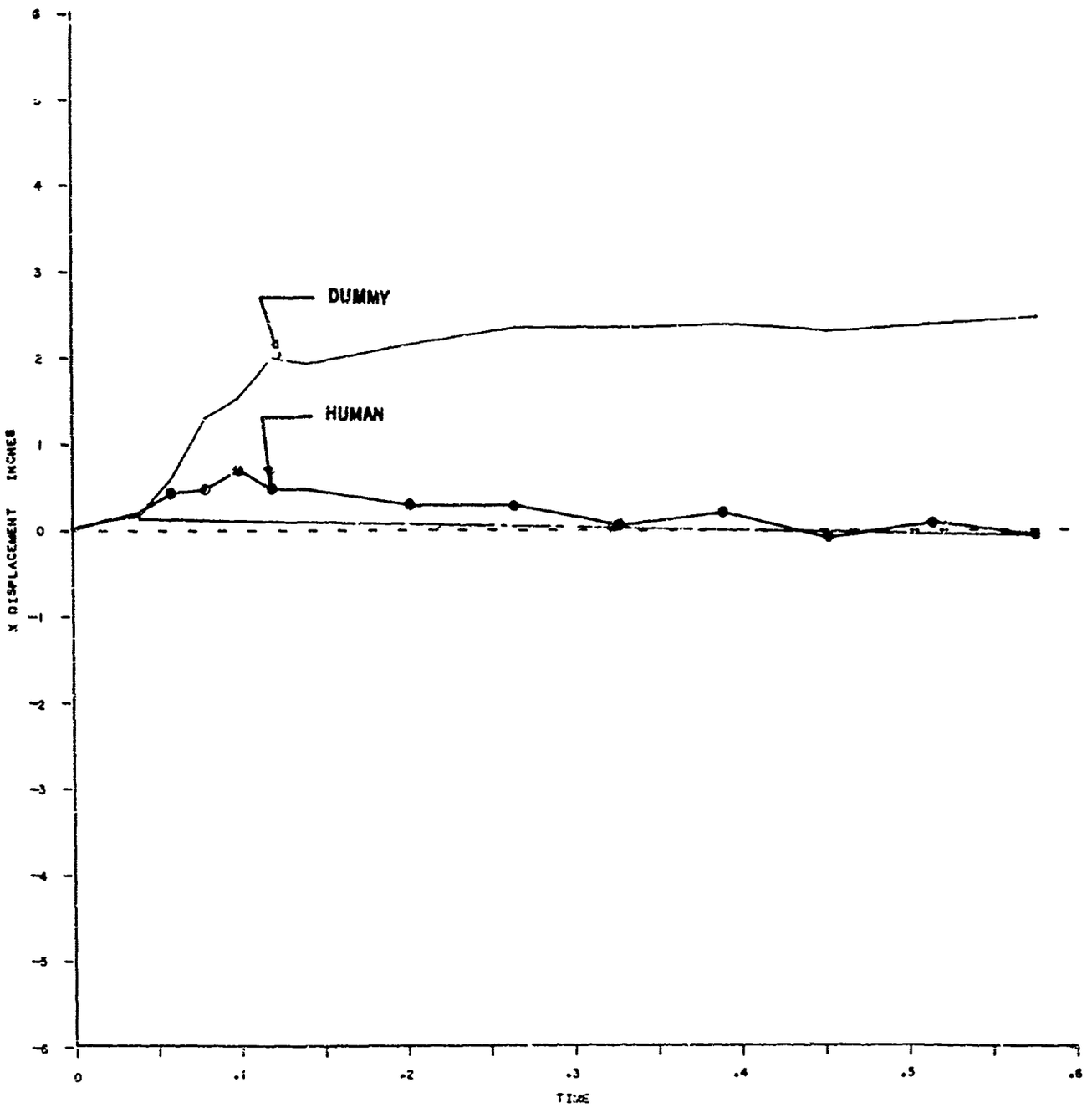
A

BROOKS & 95 %TILE DUMMY
INT - TEST NO. 60 - 8.1 G



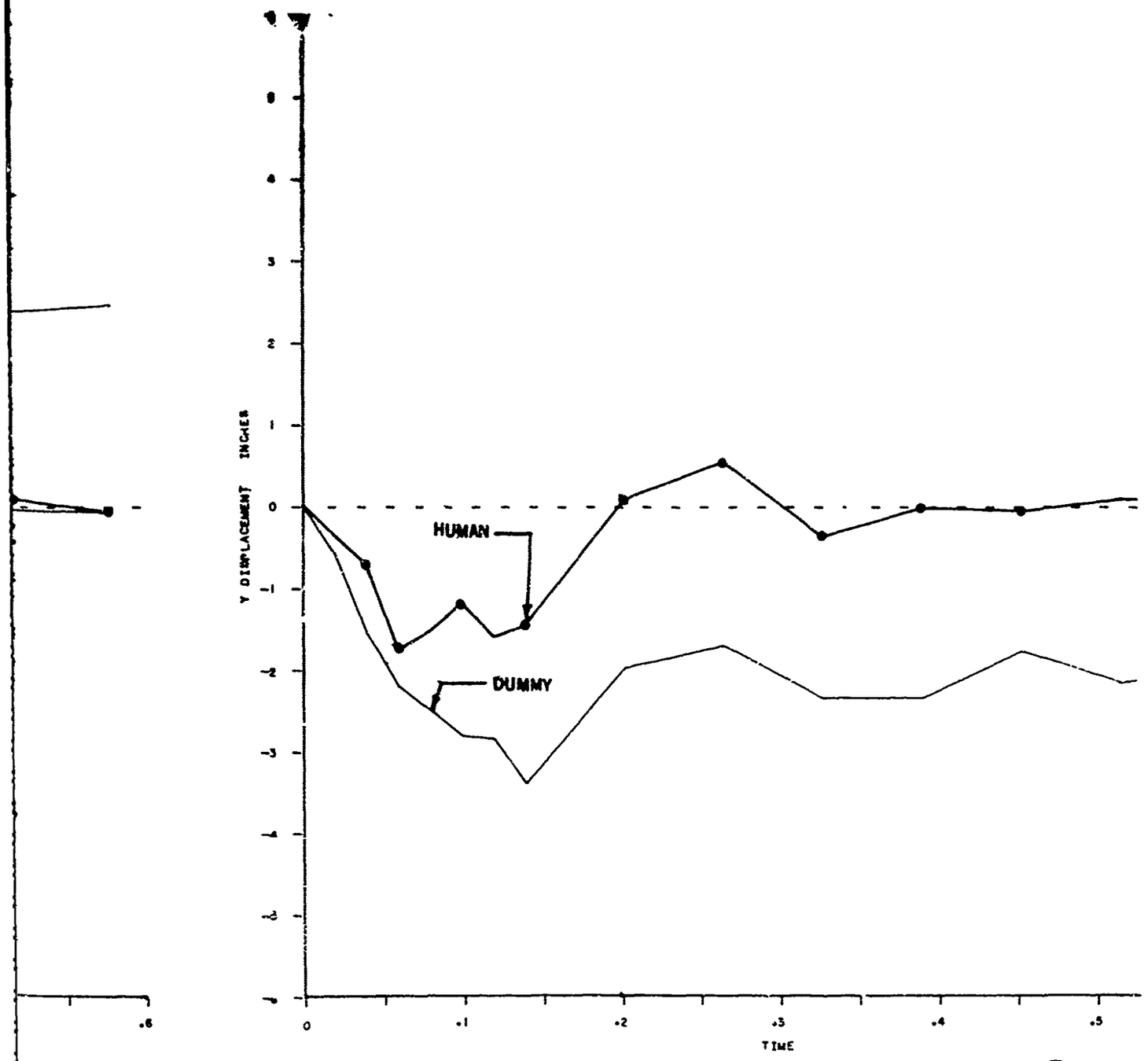
B

SUBJECTS - BROOKS &
EYE POINT - TEST



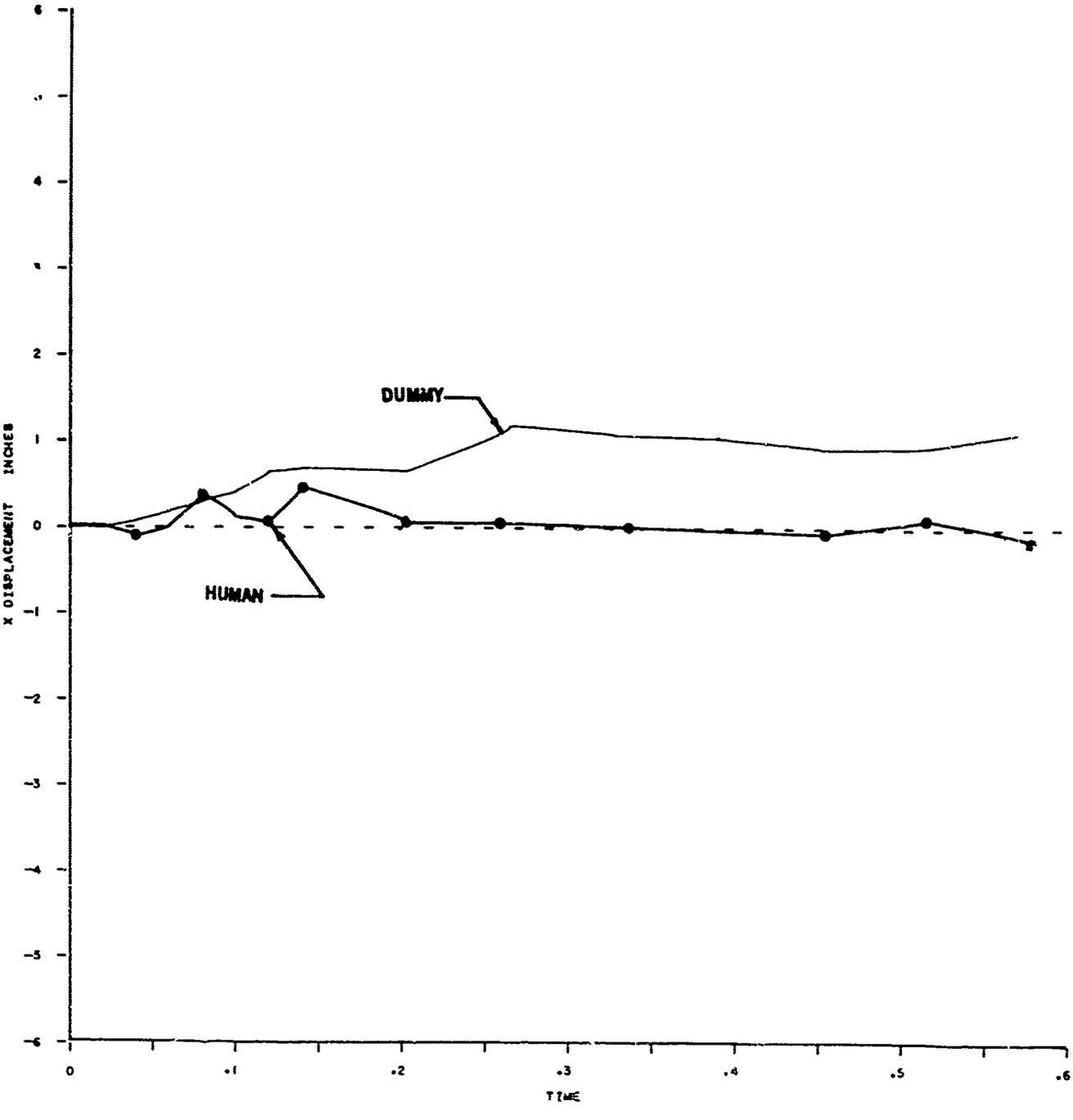
A

ROOKS && 95 %TILE DUMMY
- TEST NO. 60 -8.1 G

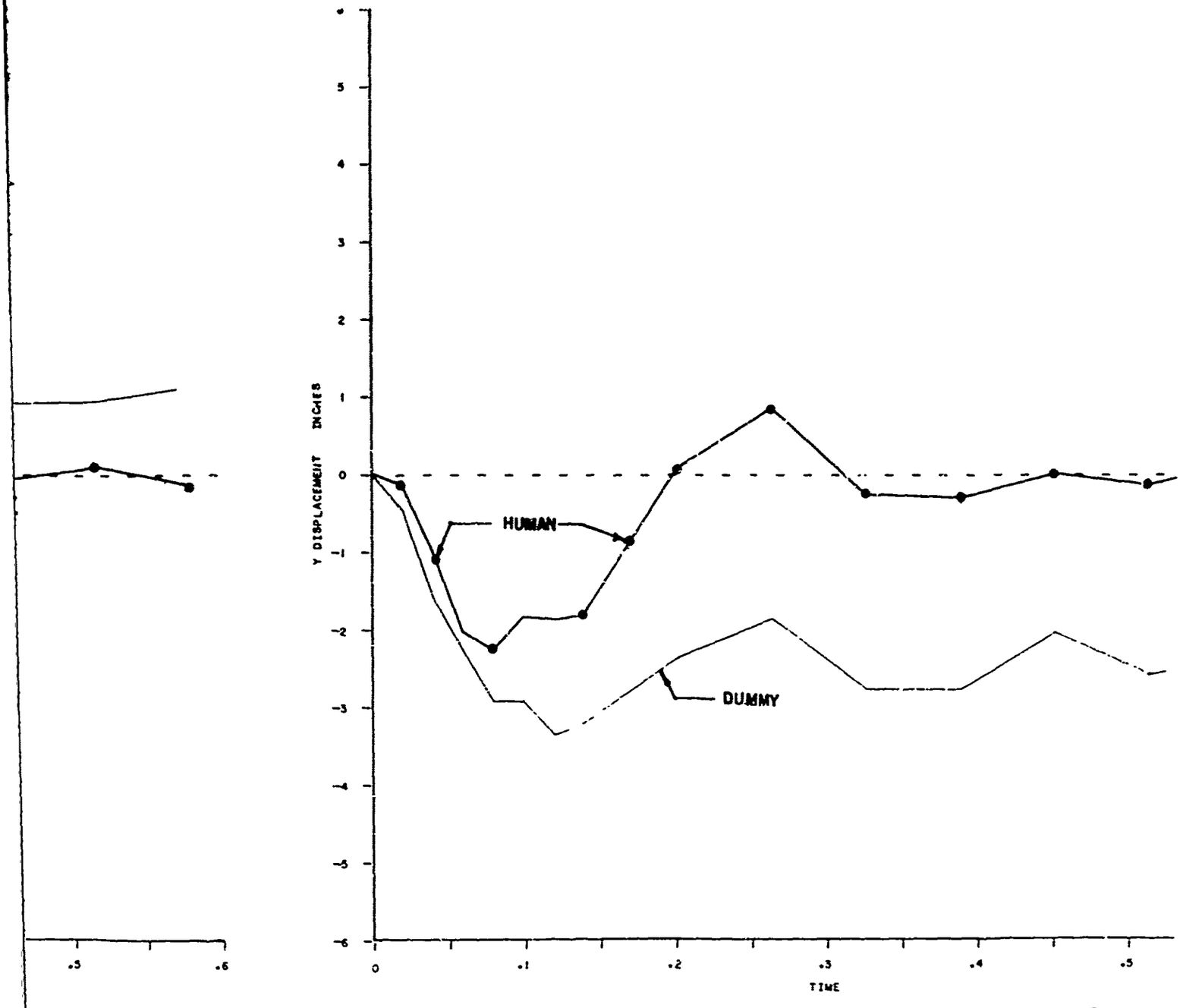


B

SUBJECTS - BROOKS & 95
NOSE POINT - TEST NO

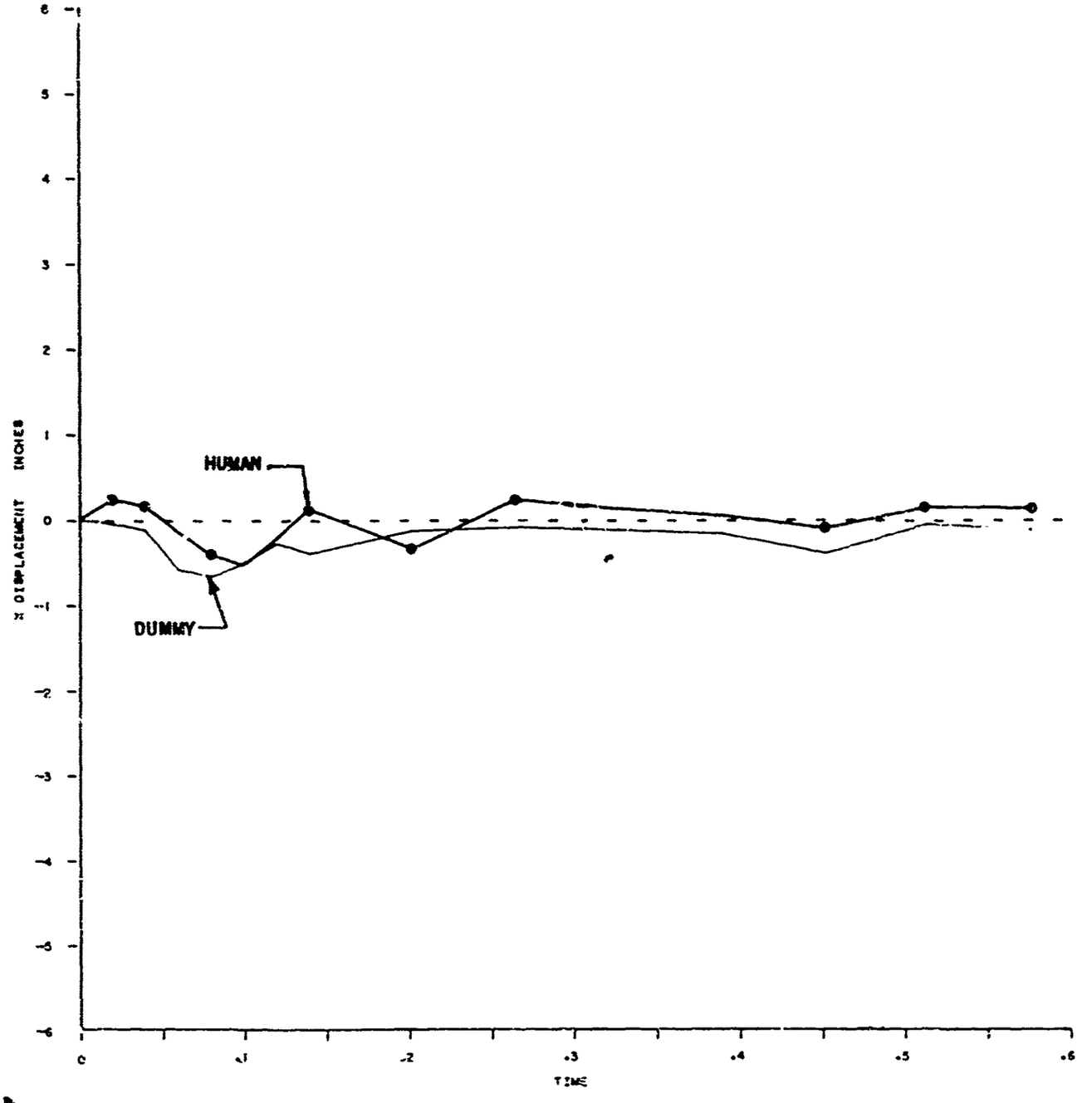


- BROOKS & 95 %TILE DUMMY
NT - TEST NO. 60 - 8.1 G



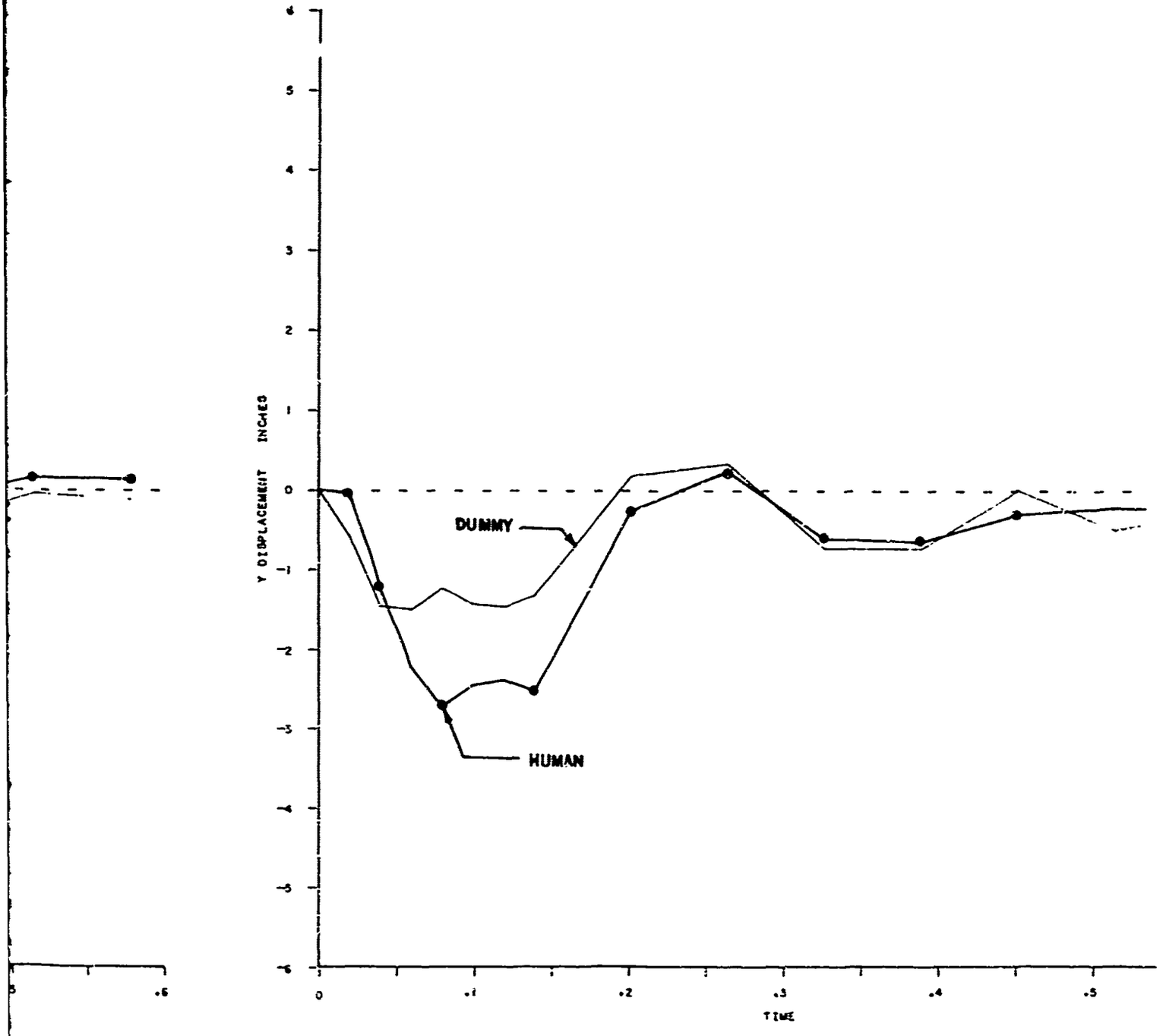
B

SUBJECTS - BROOKS & 9
SHOULDER POINT - TEST



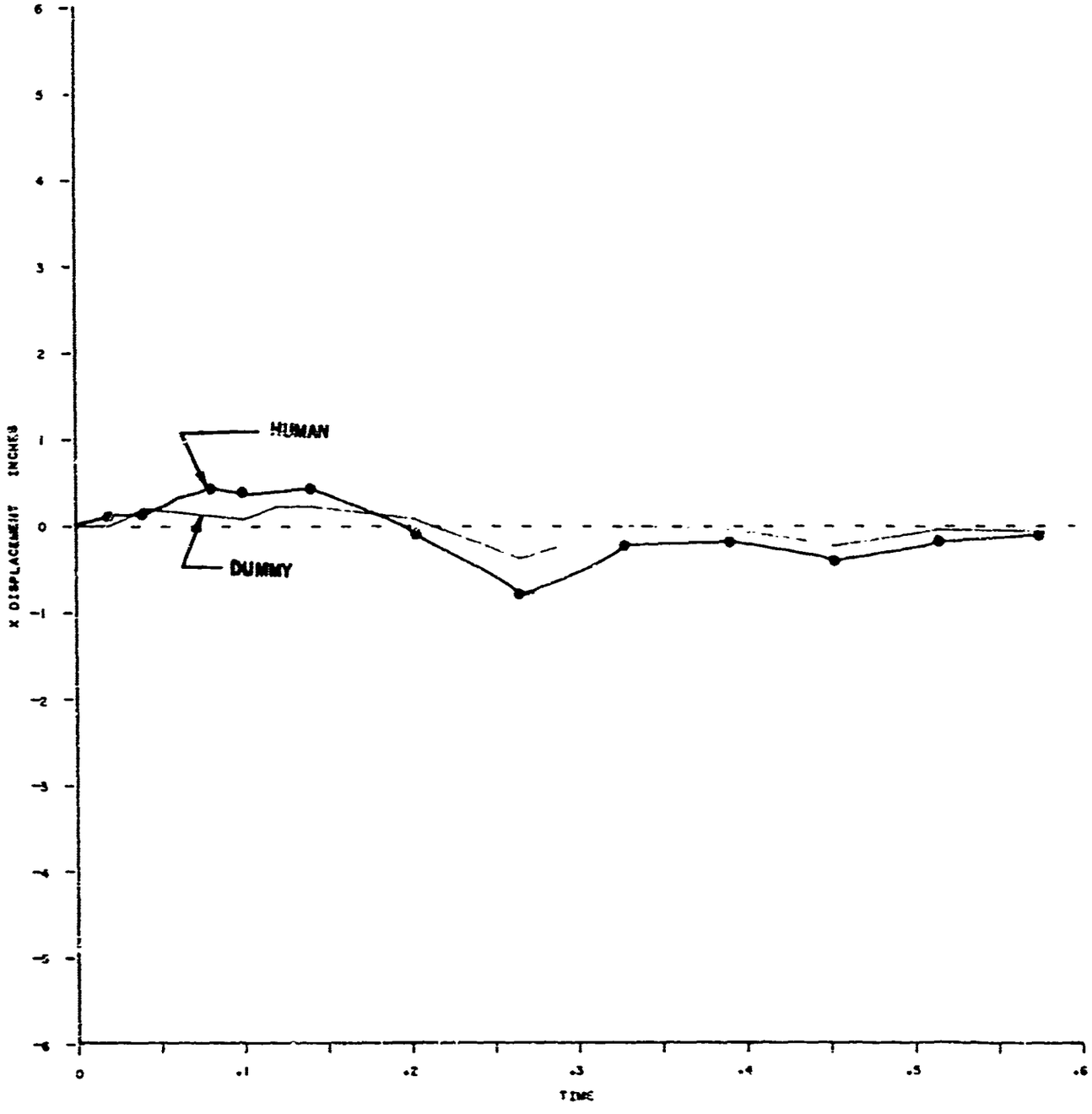
A

BROOKS & 95 % TILE DUMMY
OINT - TEST NO. 60 -8.1 G

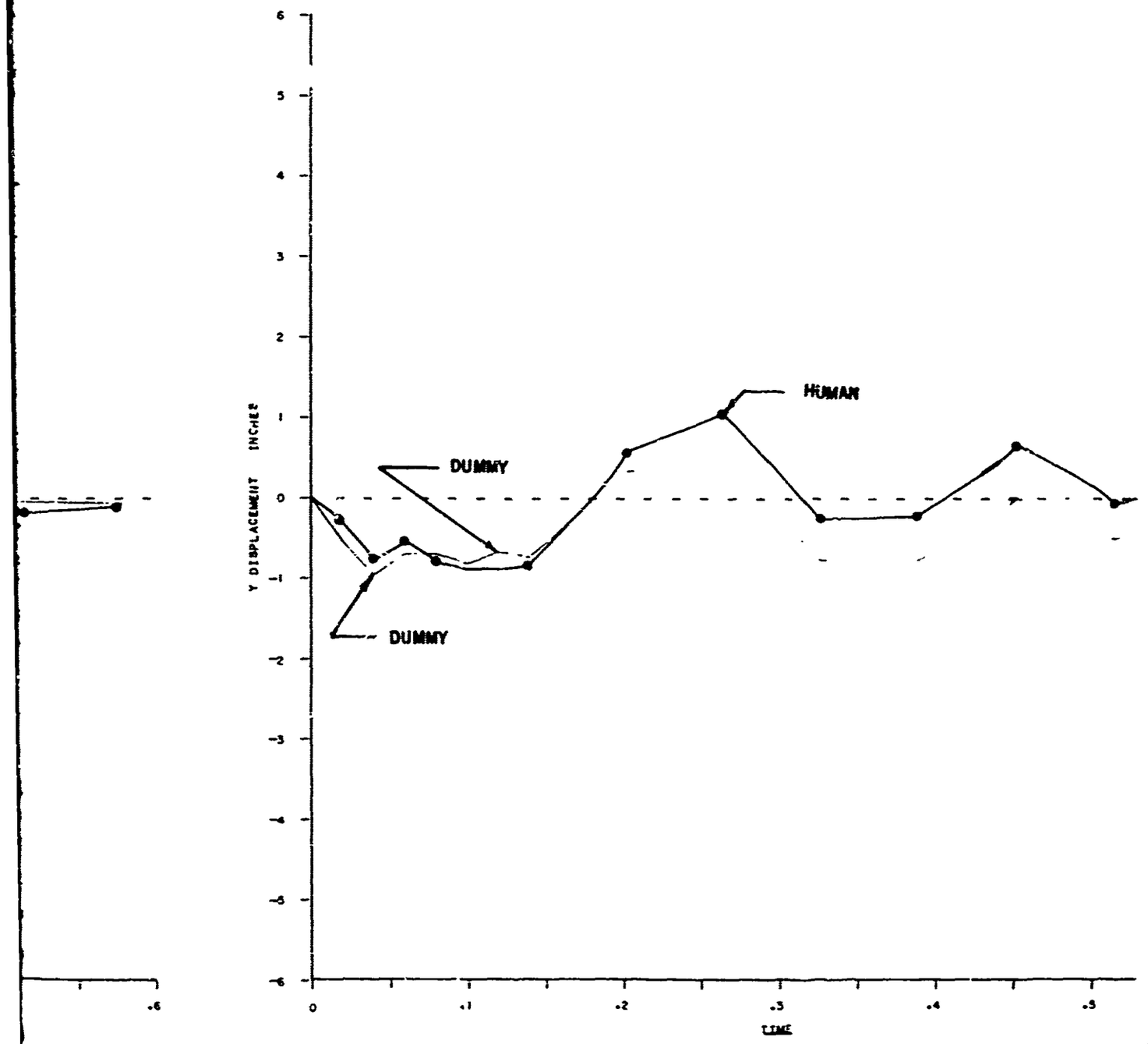


B

SUBJECTS - BROOKS & THIGH POINT - TEST

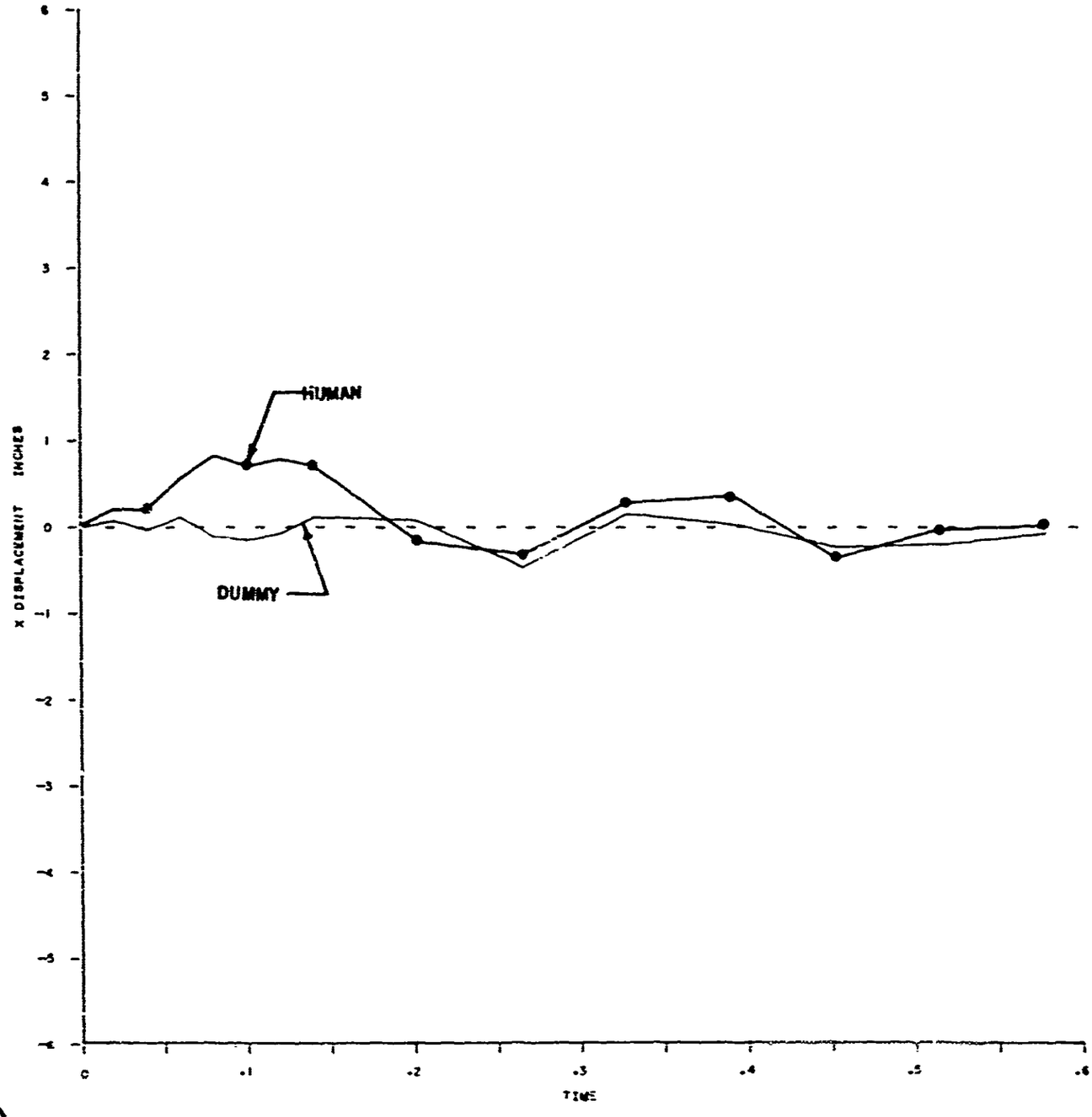


ROOKS & 95 %TILE DUMMY
T - TEST NO. 60 - 8.1 G



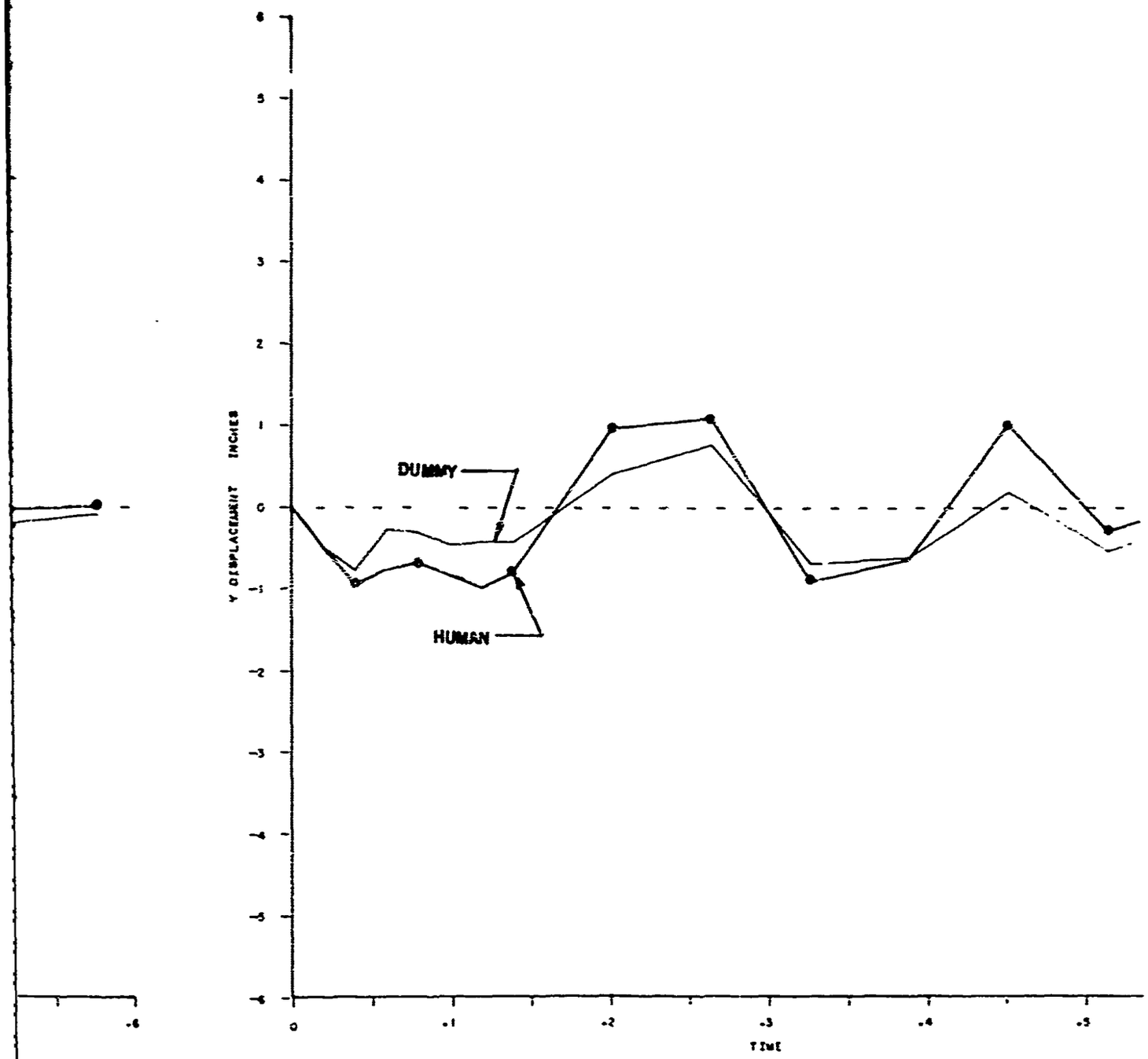
B

SUBJECTS - BROOKS & S
KNEE POINT - TEST N



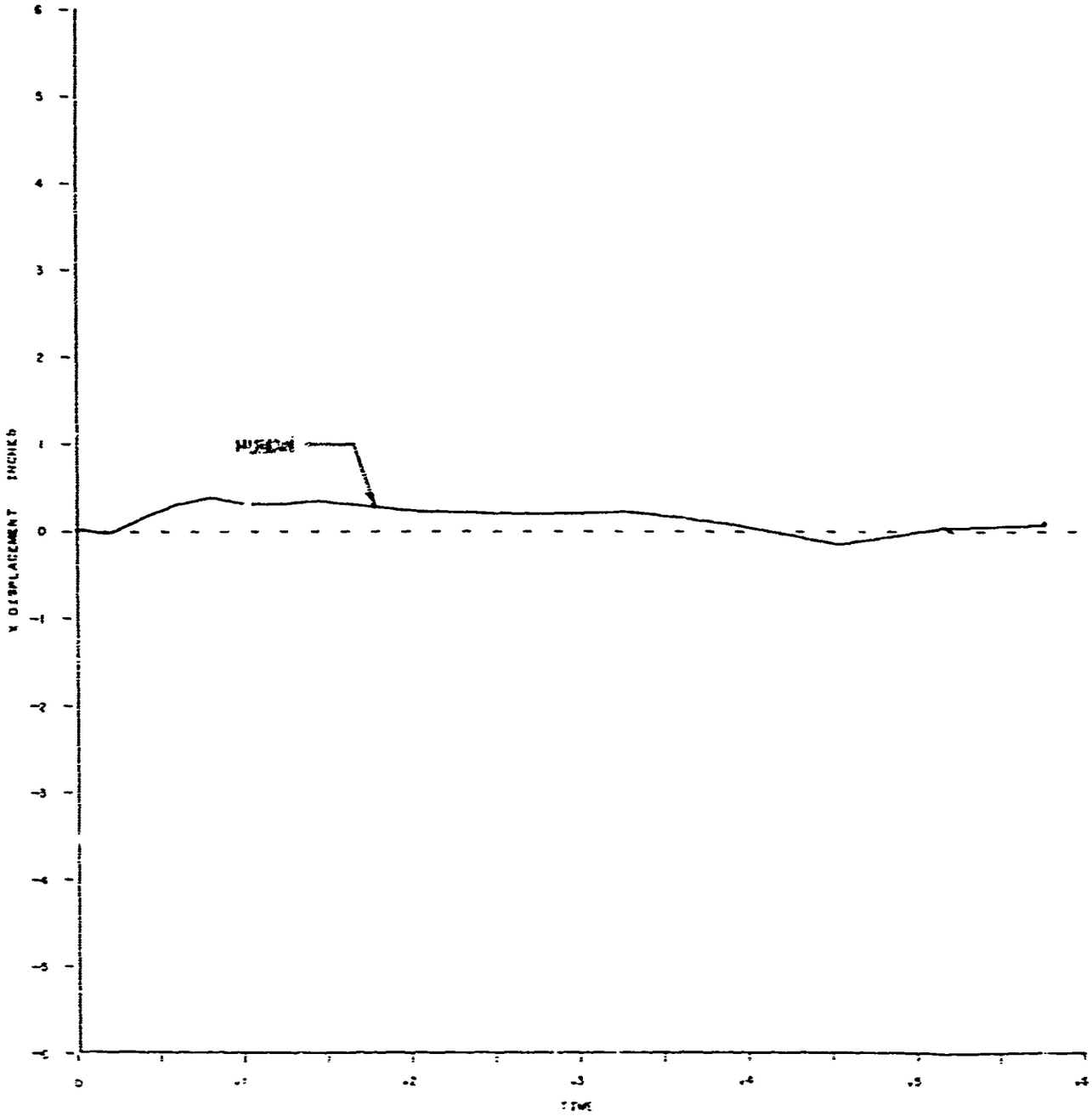
A

BOKS & 95 %TILE DUMMY
- TEST NO 60 - 8.1 G

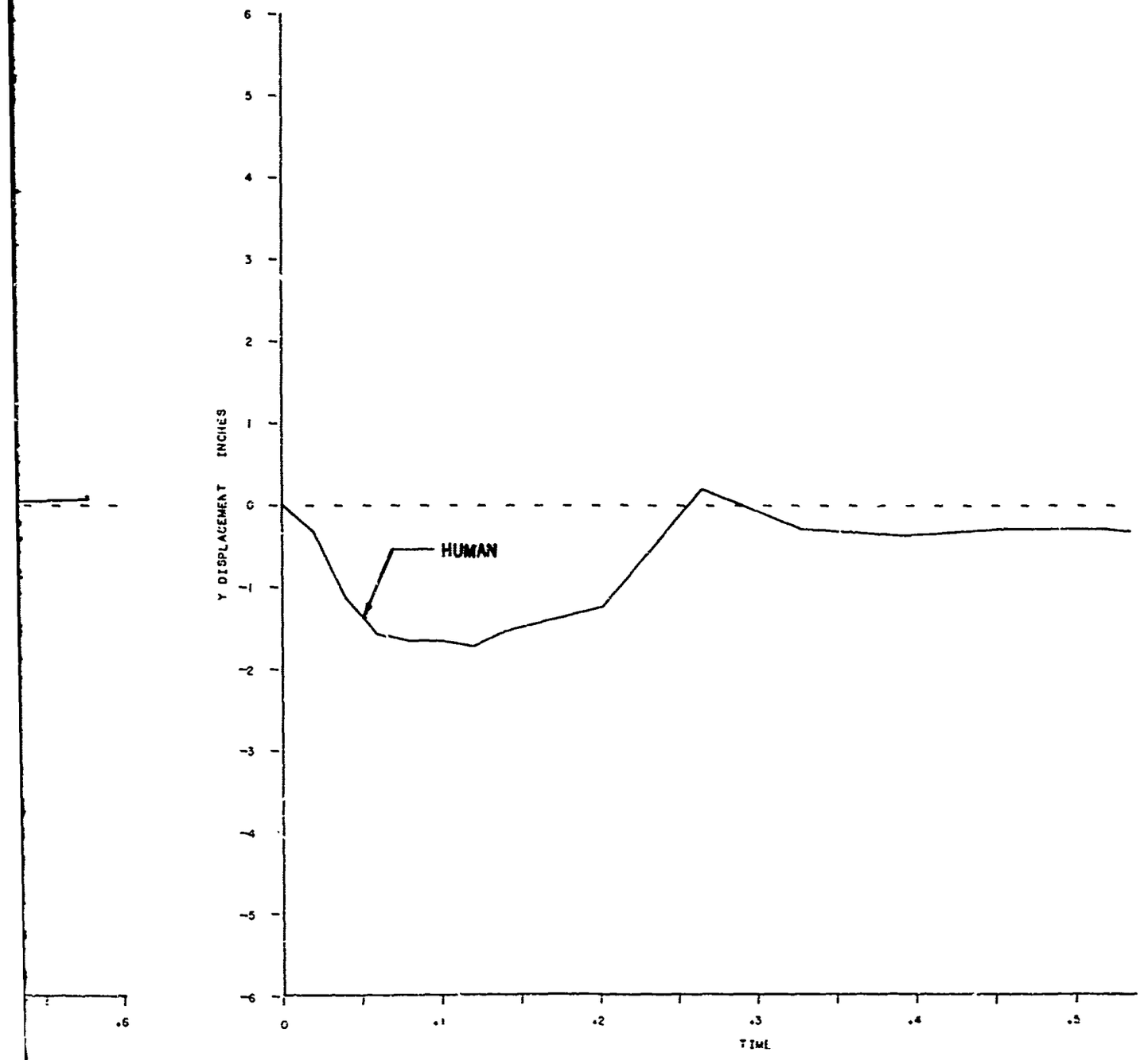


B

SUBJECTS - BROOKS
TEMPLE POINT -

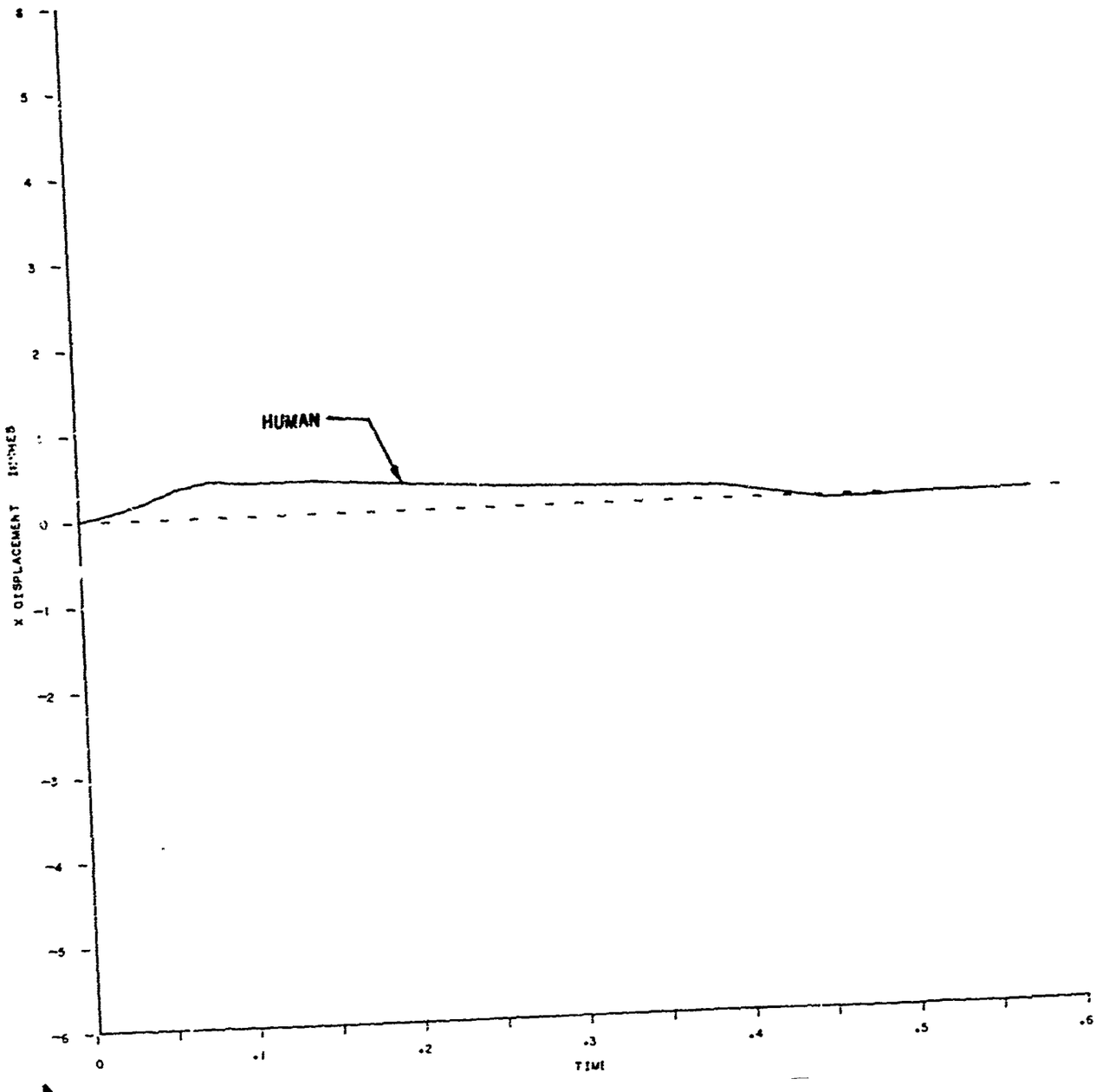


- BROOKS & 95 %TILE DUMMY
POINT - TEST NO. 39 - 9 G



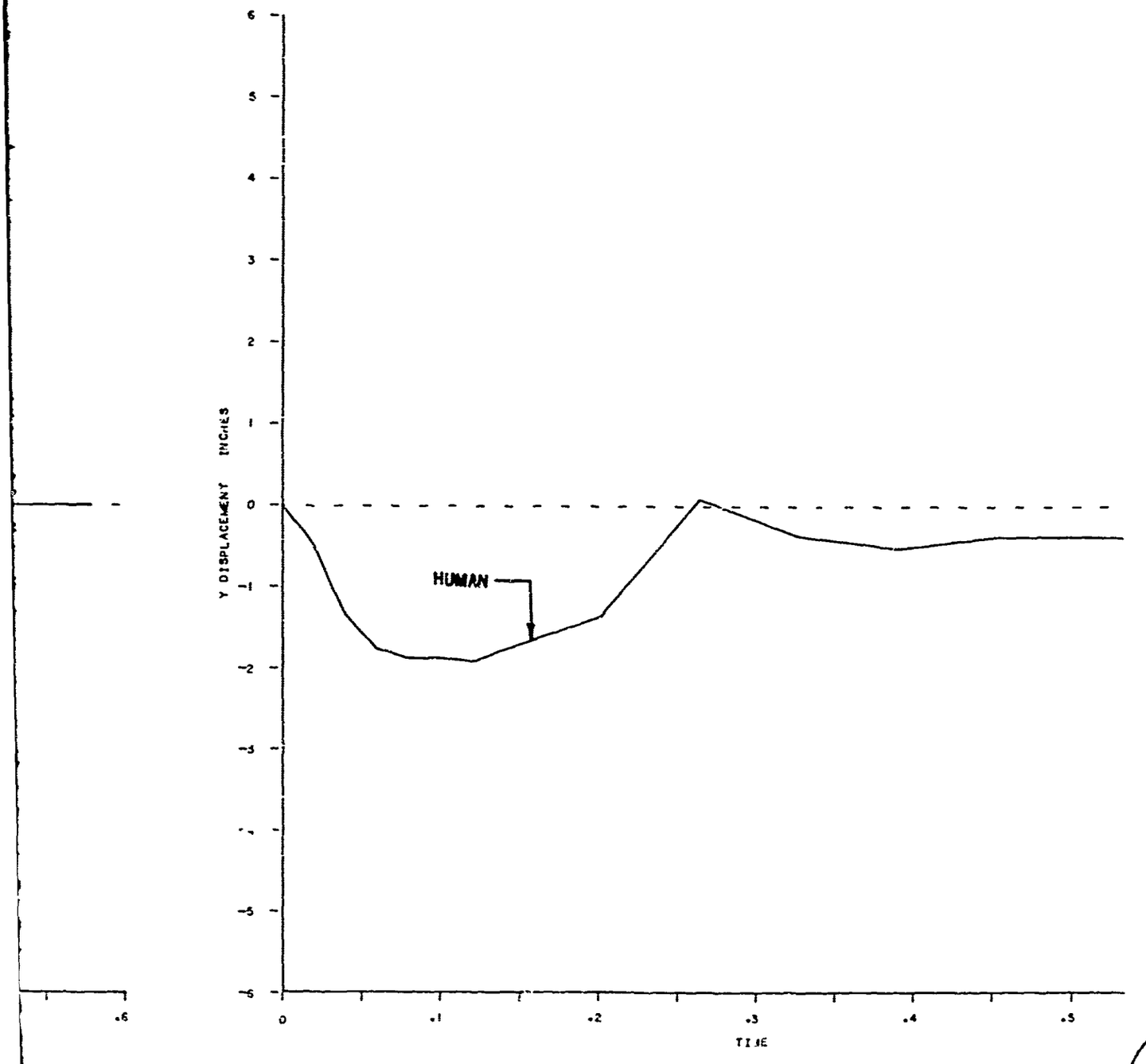
B

SUBJECTS - BROOKS &
EYE POINT - TEST N



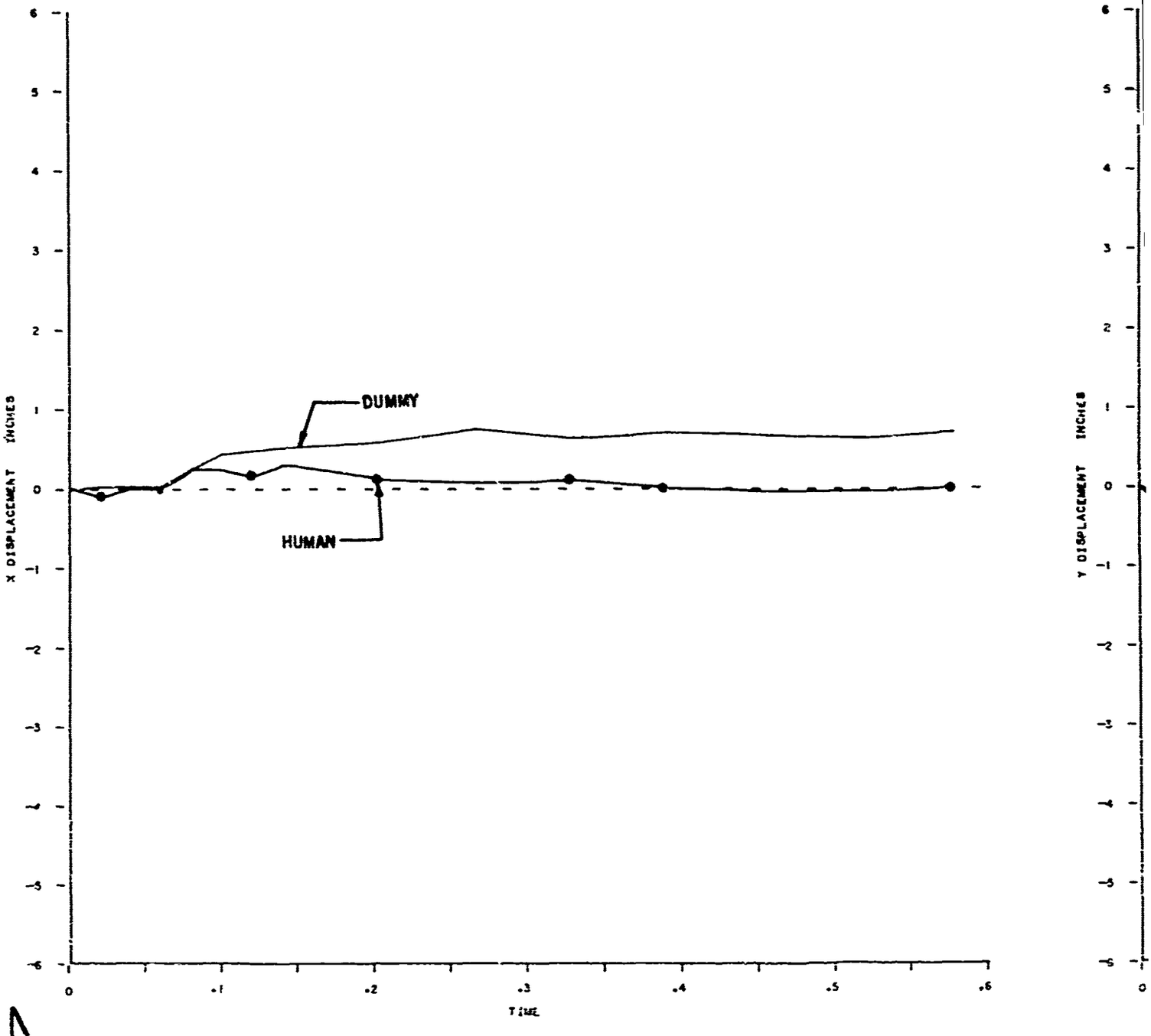
A

BROOKS & 95 %TILE DUMMY
T - TEST NO. 39 - 9 G



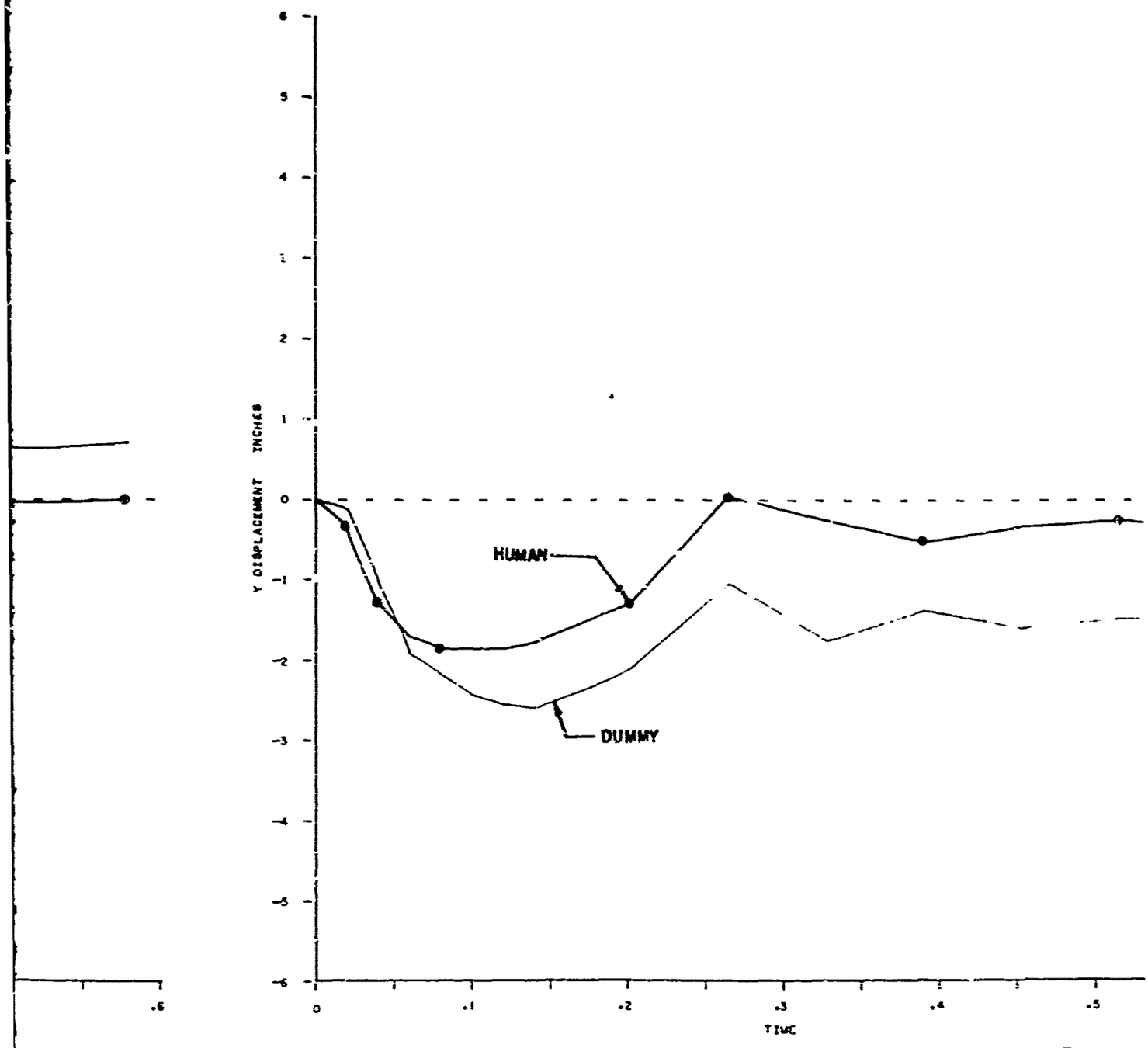
B

SUBJECTS - BROOKS & NOSE POINT - TEST



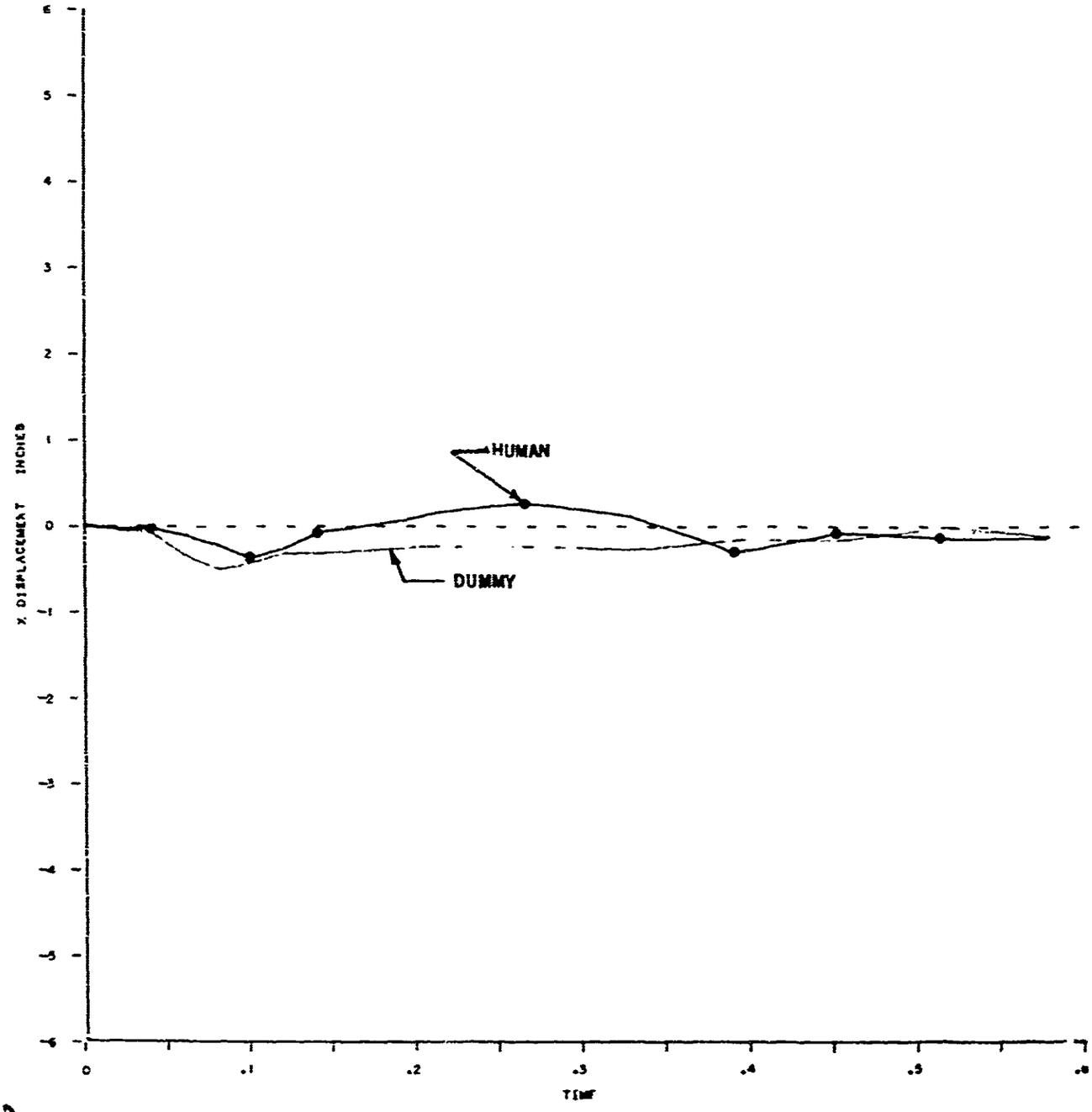
A

- BROOKS & 95 %TILE DUMMY
POINT - TEST NO. 39 - 9 G



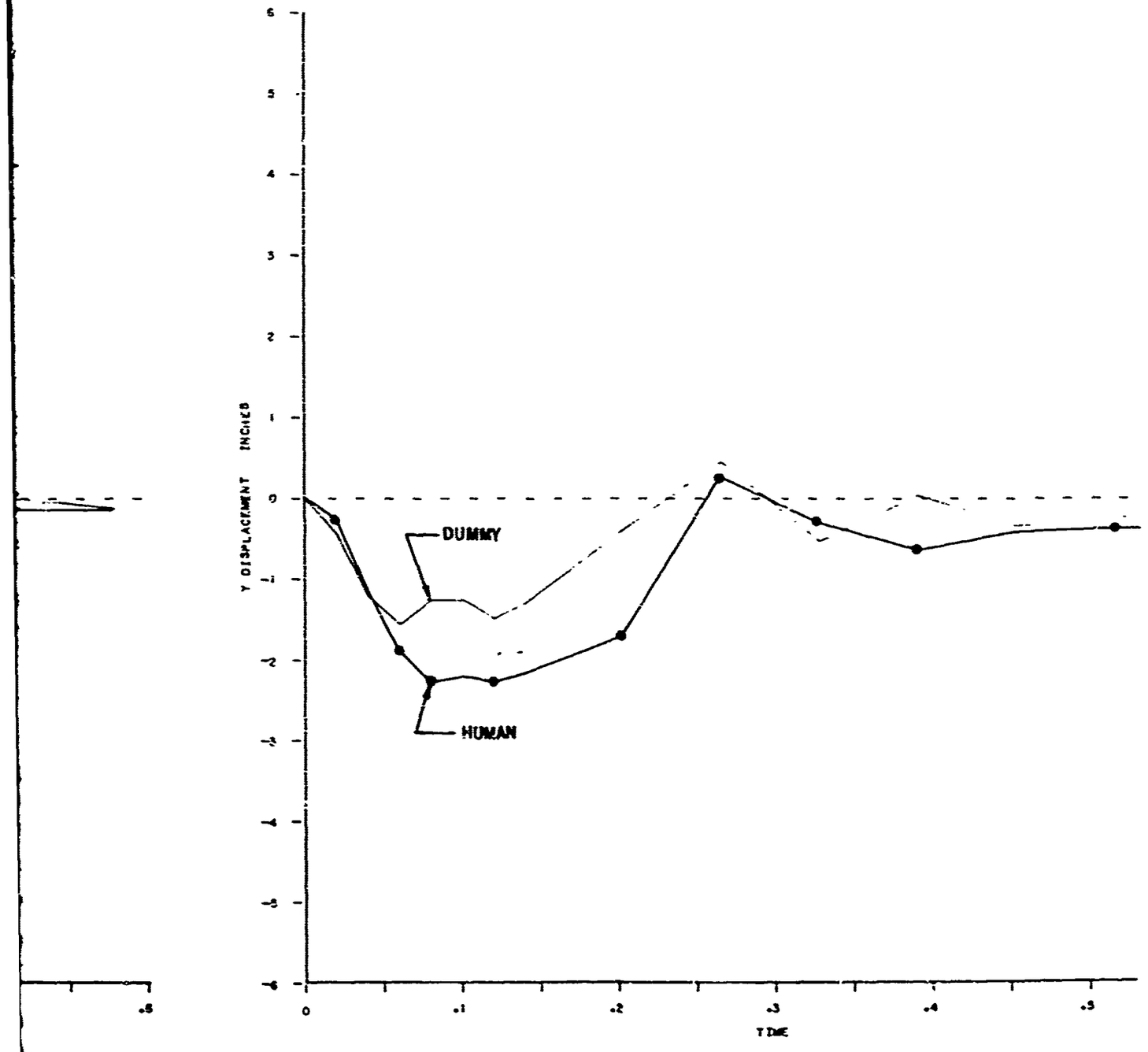
B

SUBJECTS - BROOK
SHOULDER POINT



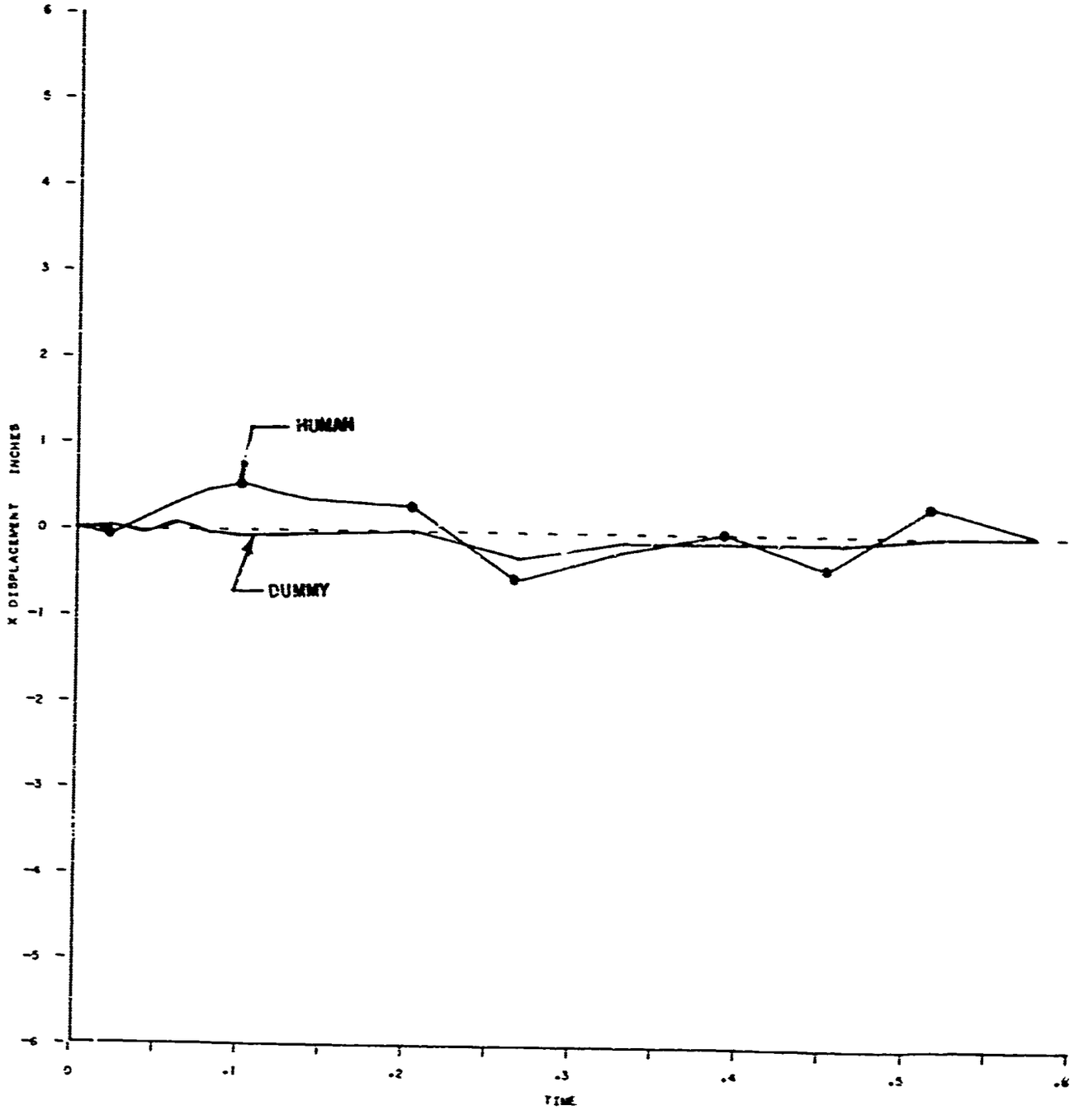
A

S - BROOKS & 95 %TILE DUMMY
DER POINT - TEST NO.39 - 9 G

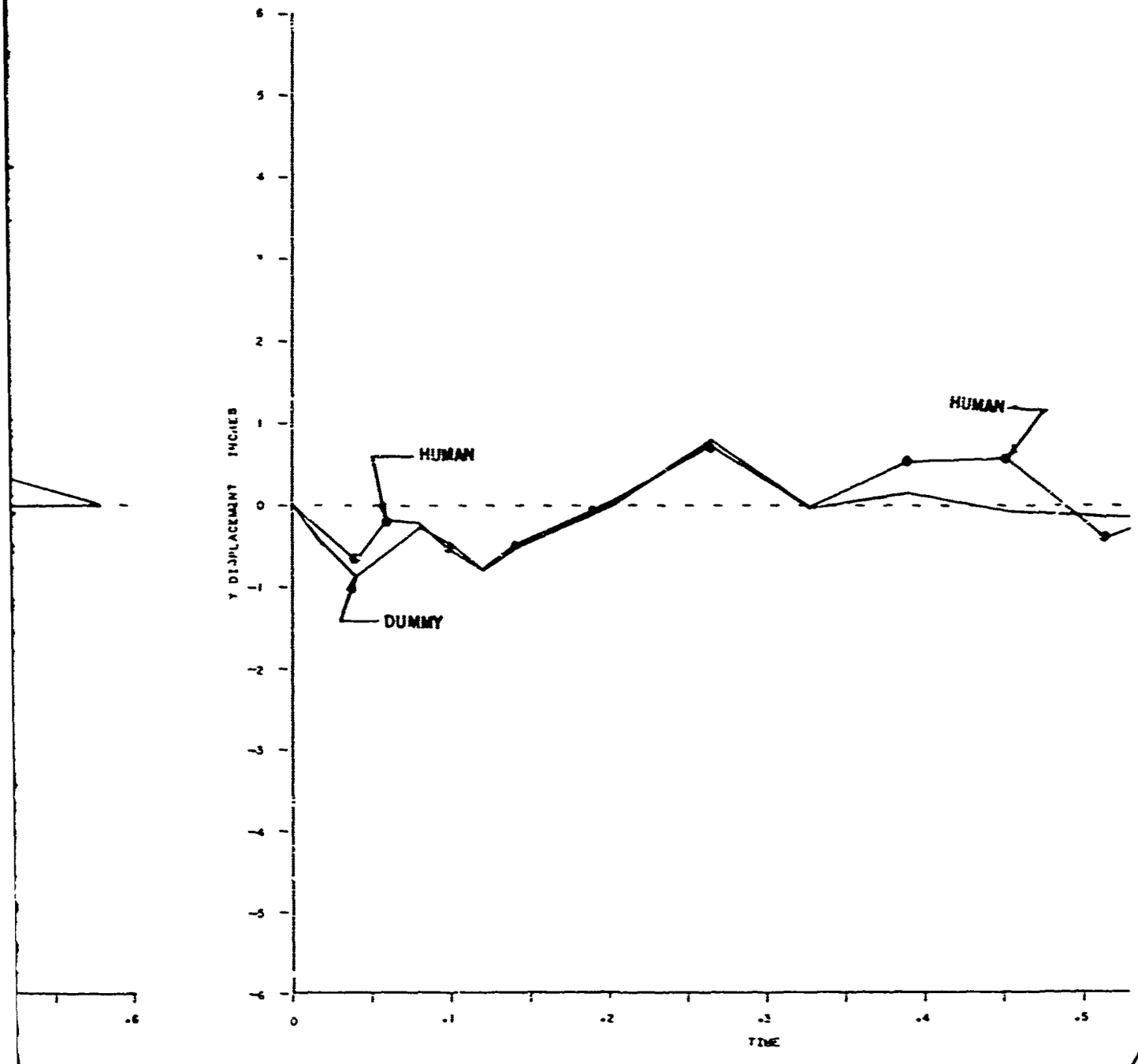


B

SUBJECTS - BROOKS
KNEE POINT -

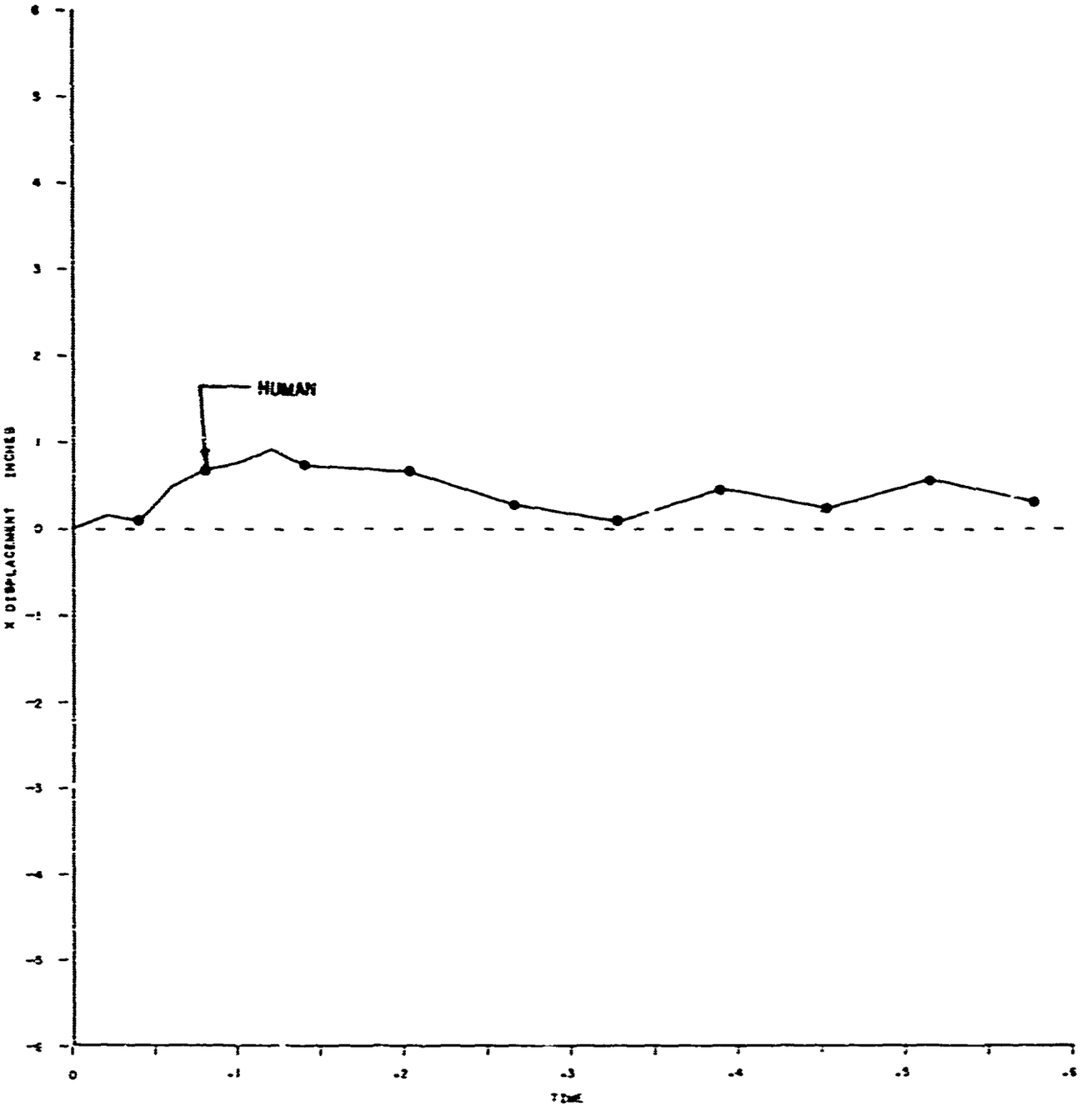


BROOKS & 95 %TILE DUMMY
POINT - TEST NO. 39 - 9 G



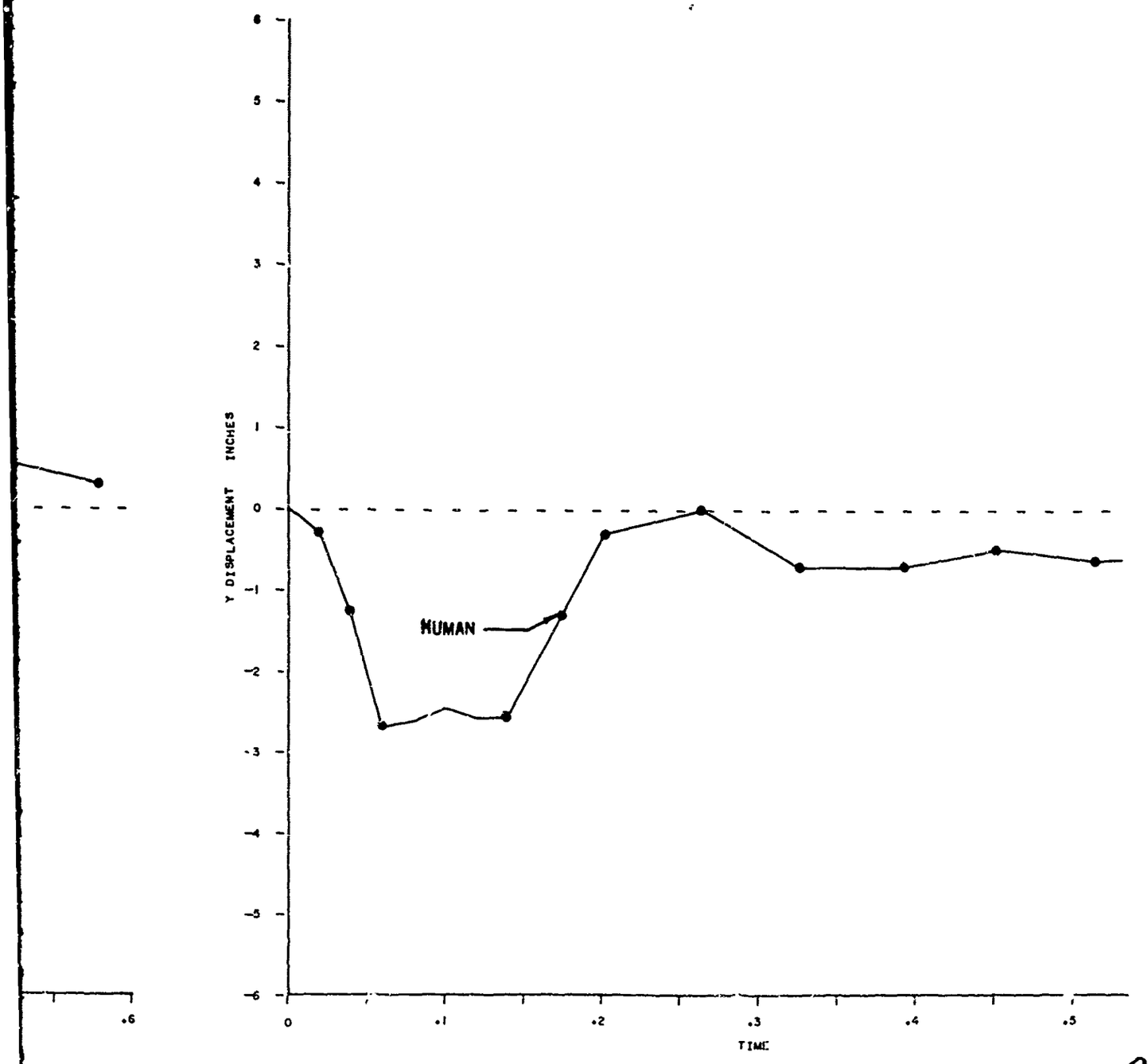
B

SUBJECTS - BROOKS & 9
TEMPLE POINT - TEST



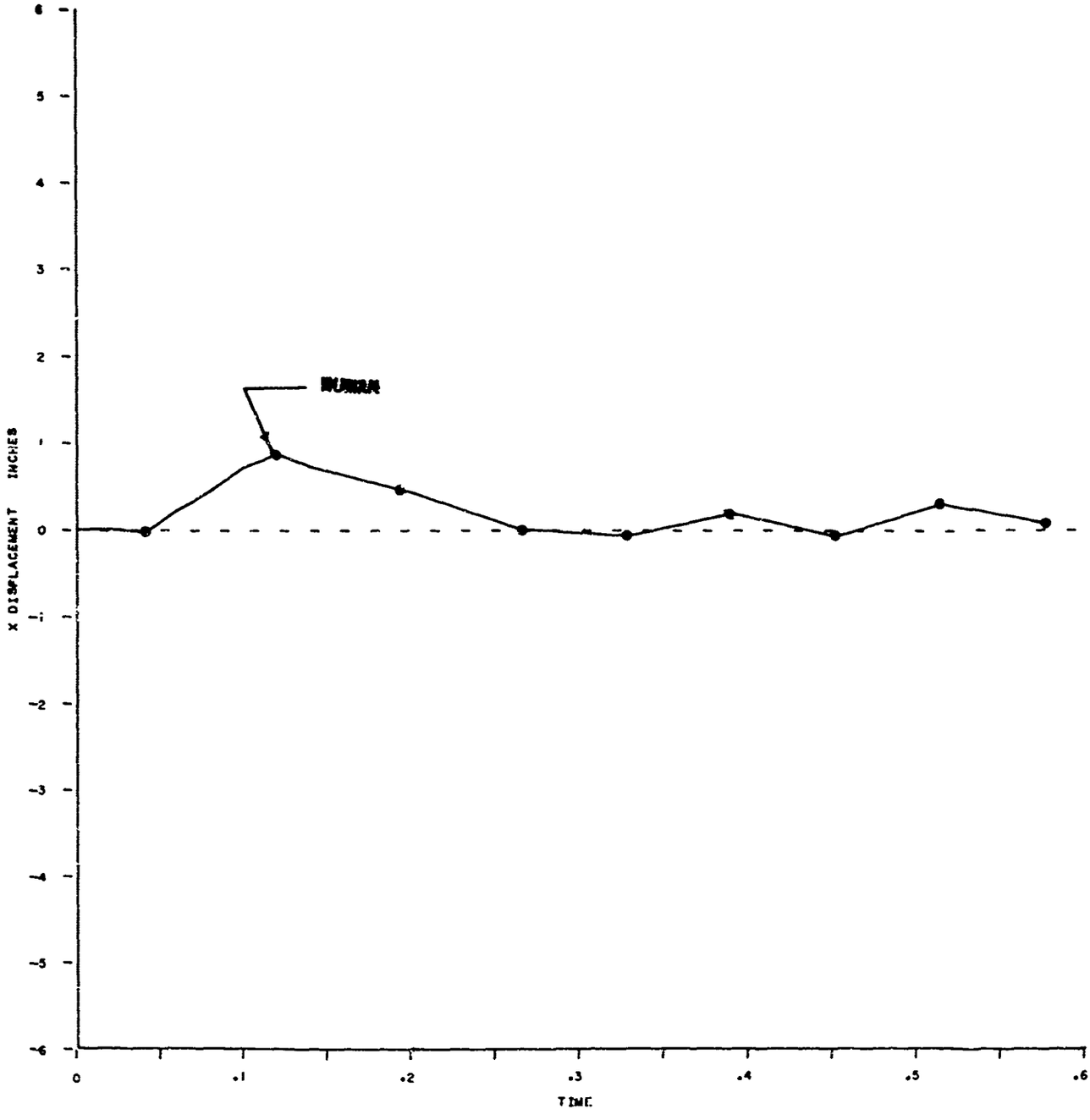
A

OOKS & 95 %TILE DUMMY
T - TEST NO. 40 - 10 G

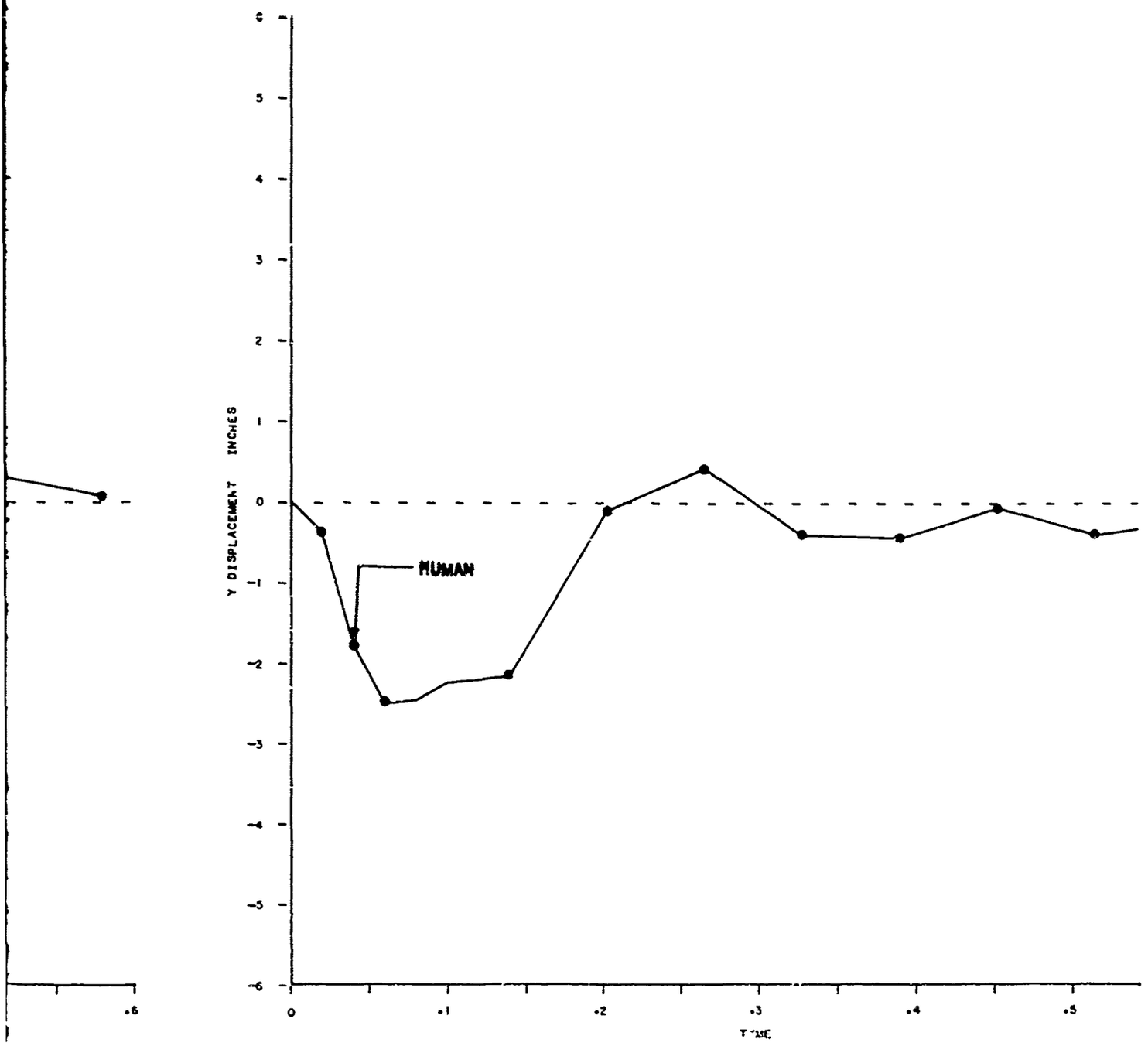


B

SUBJECTS - BROOKS &
EYE POINT - TEST N

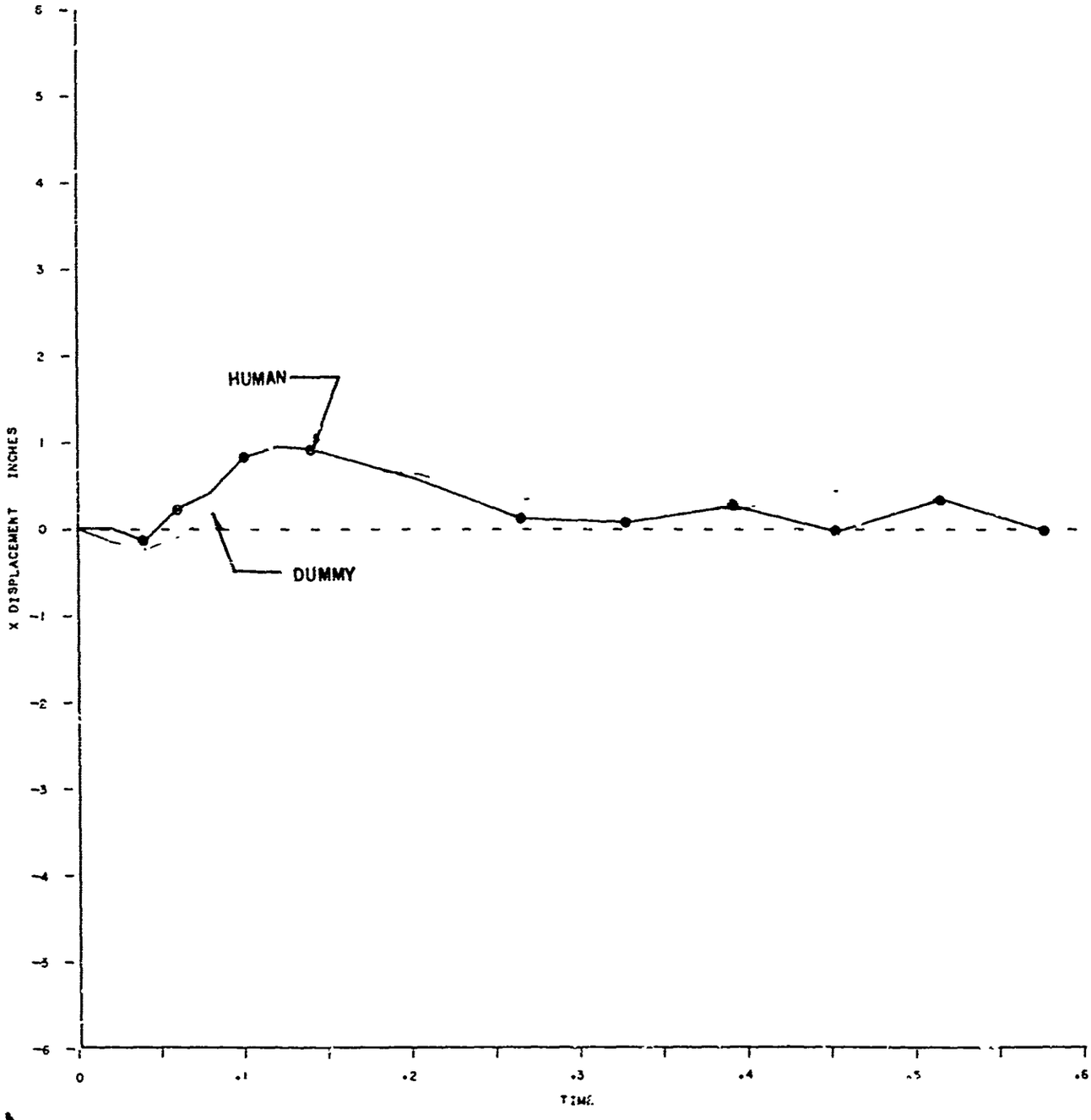


BROOKS & 95 %TILE DUMMY
- TEST NO. 40 -10 G



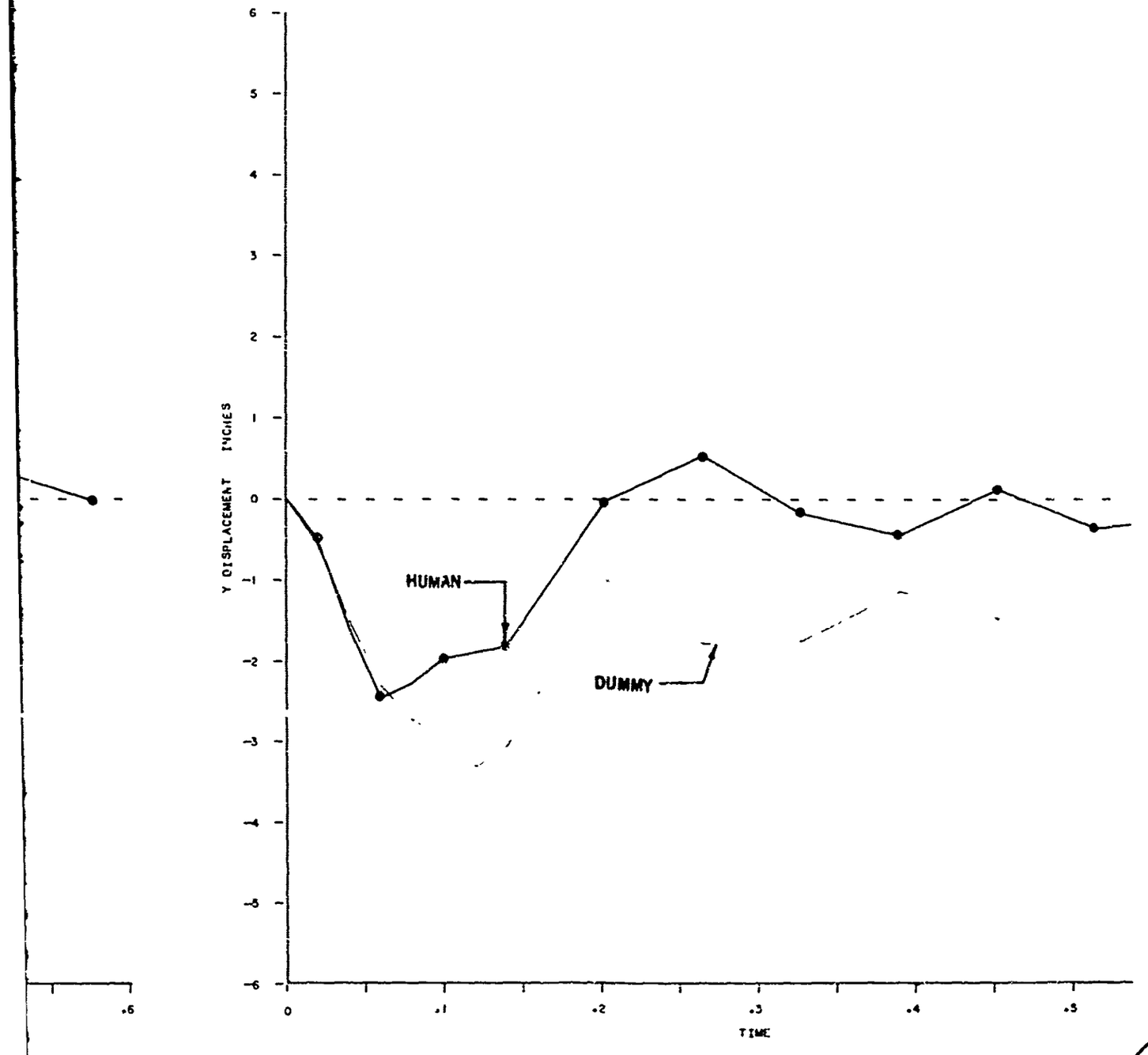
B

SUBJECTS - BROOKS &
NOSE POINT - TEST



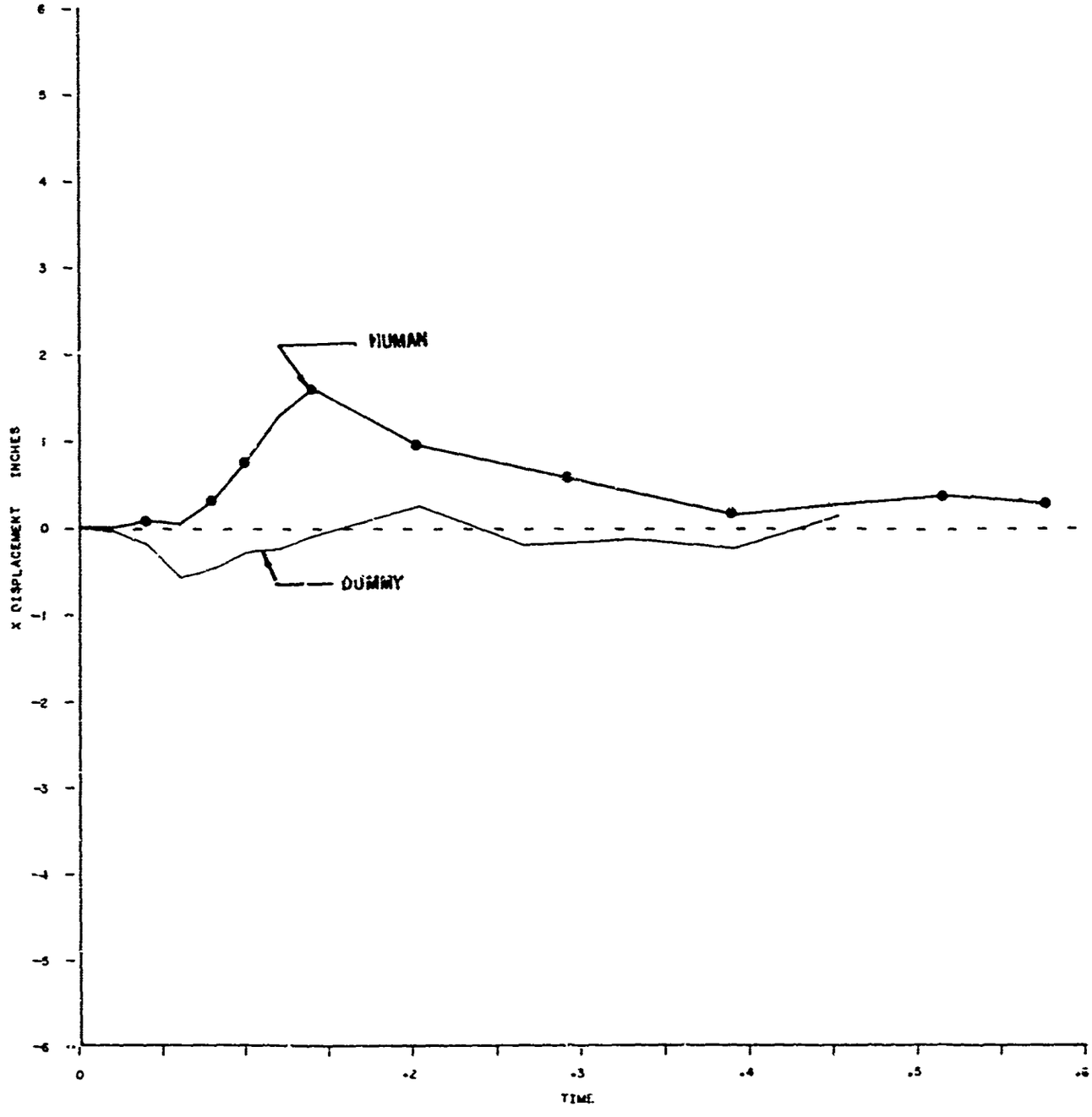
A

BROOKS & 95 %TILE DUMMY
NT - TEST NO. 40 --10 G

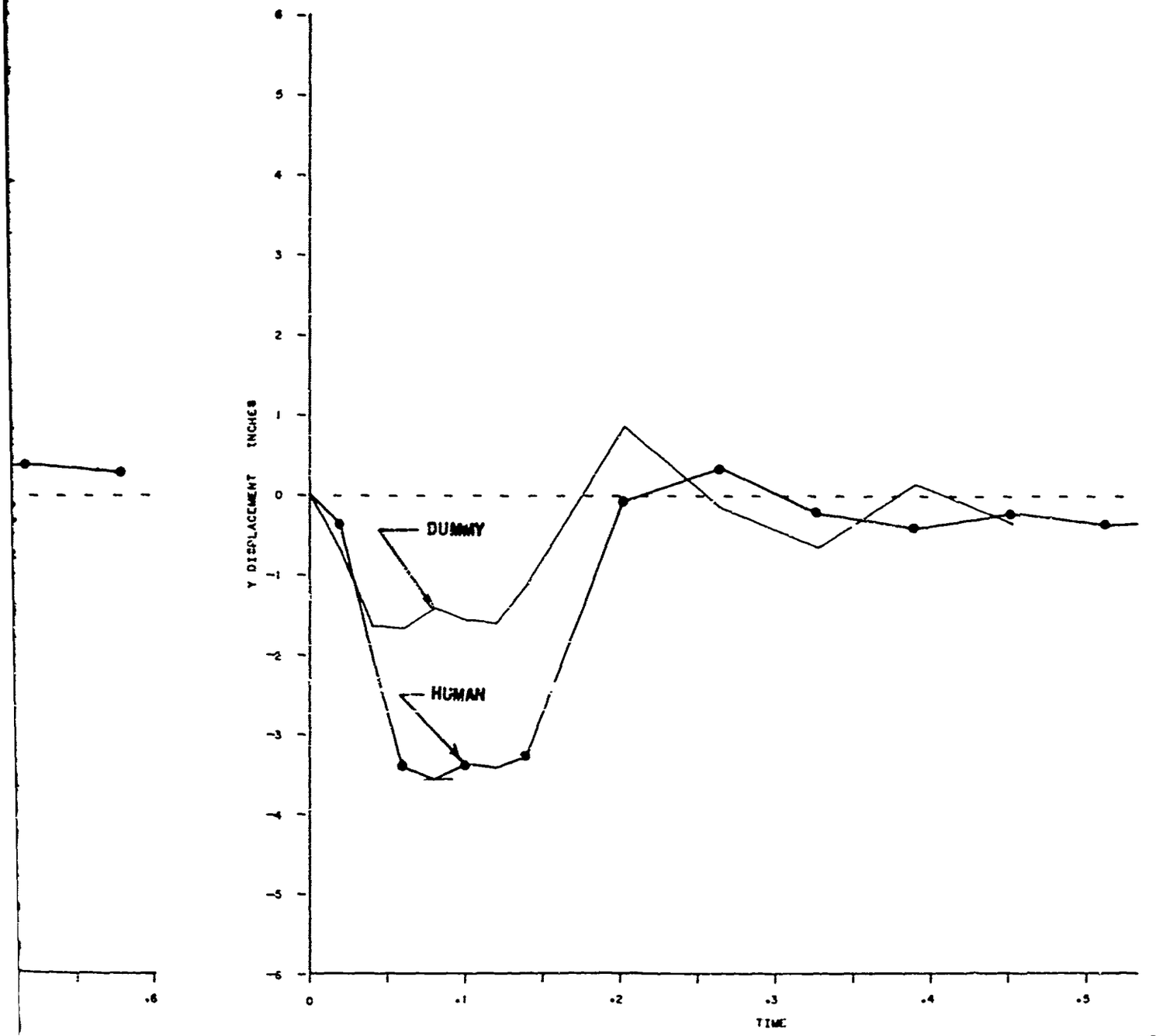


B

SUBJECTS - BROOKS
SHOULDER POINT -

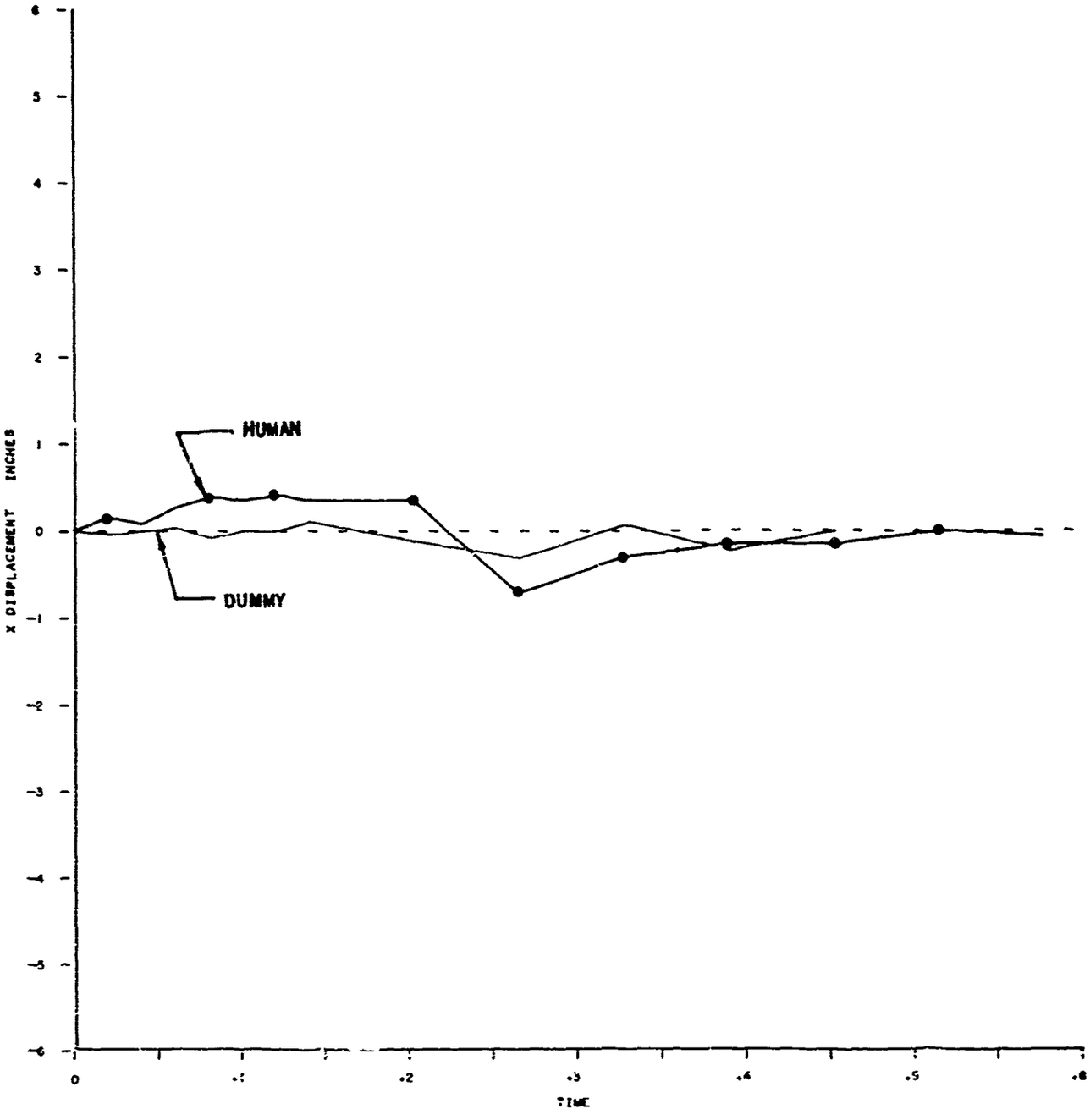


- BROOKS & 95 %TILE DUMMY
POINT - TEST NO. 40 - 10 G

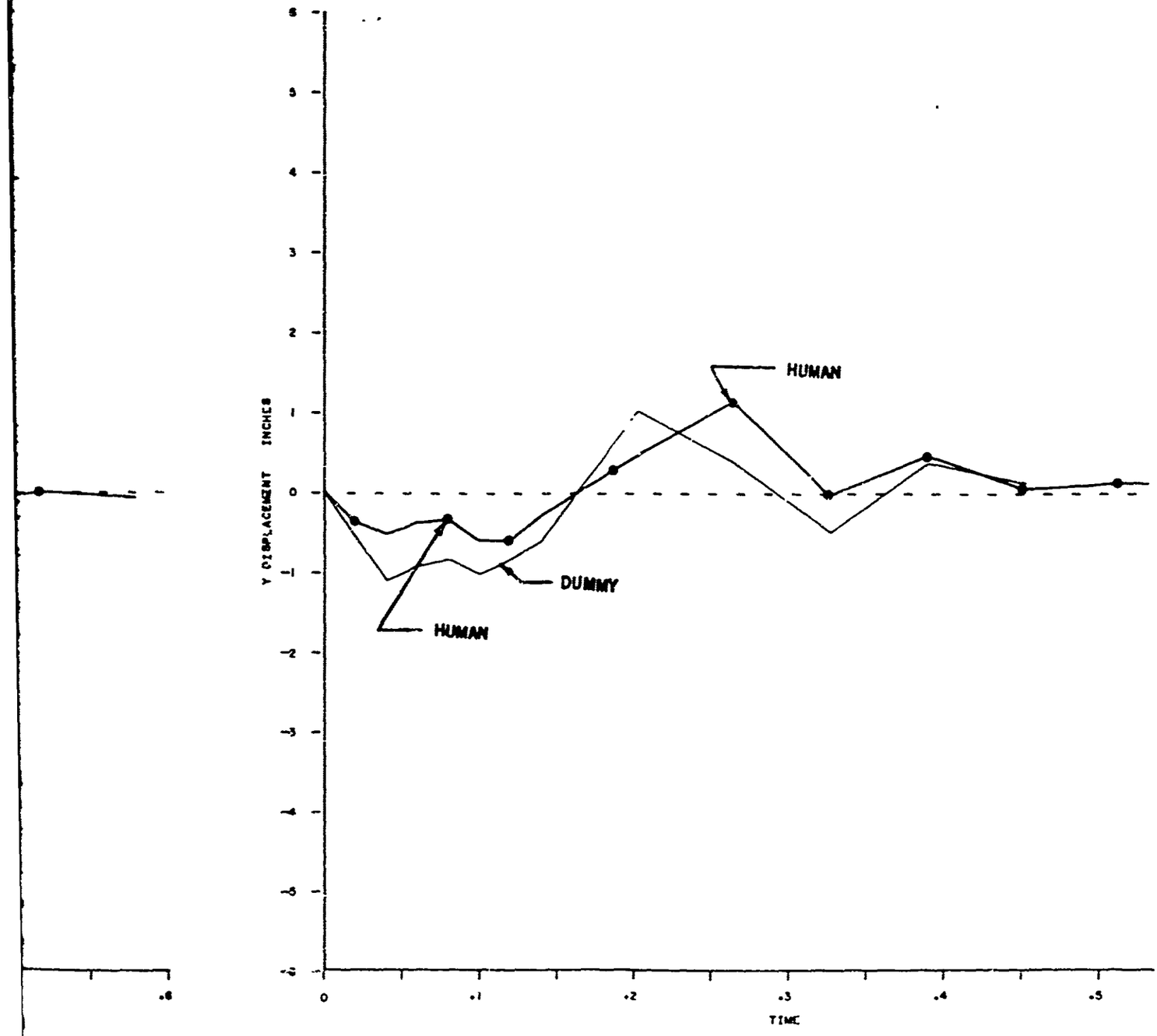


B

SUBJECTS - BROOKS & THIGH POINT - TEST

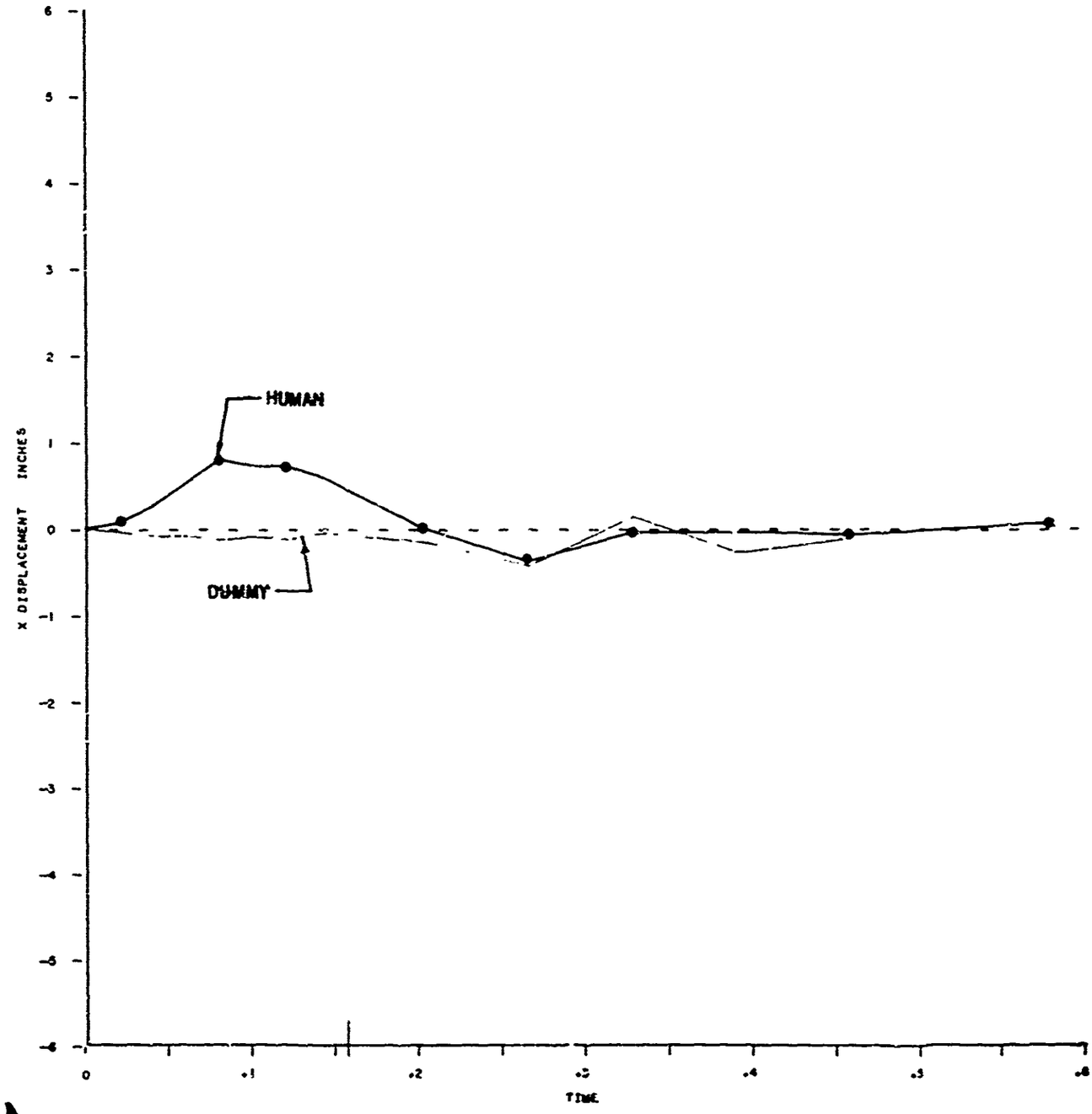


BROOKS & 95 %TILE DUMMY
DINT - TEST NO. 40 - 10 G

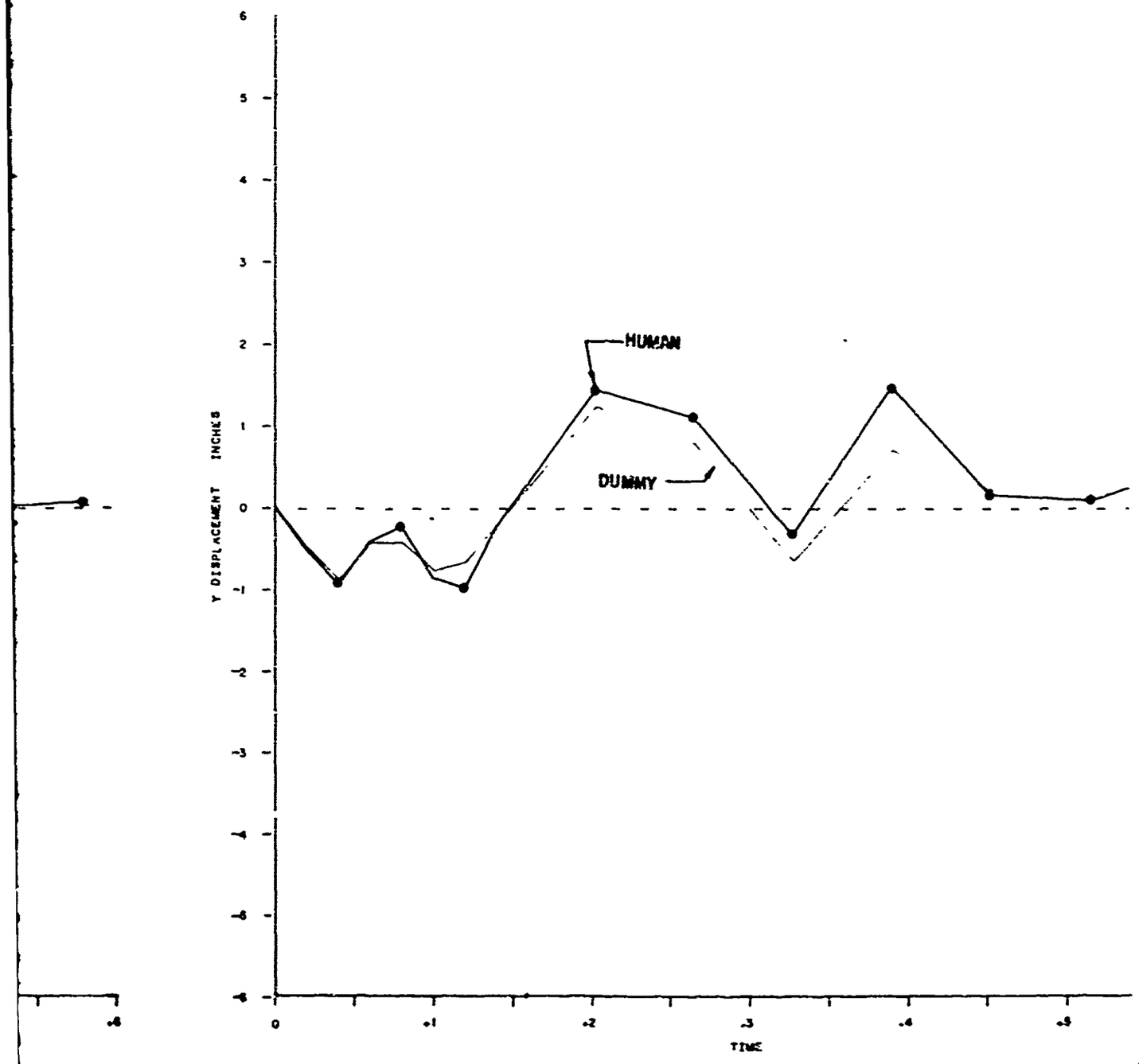


B

SUBJECTS - BROOKS & KNEE POINT - TEST



ROOKS & 95 %TILE DUMMY
T - TEST NO. 40 - 10 G



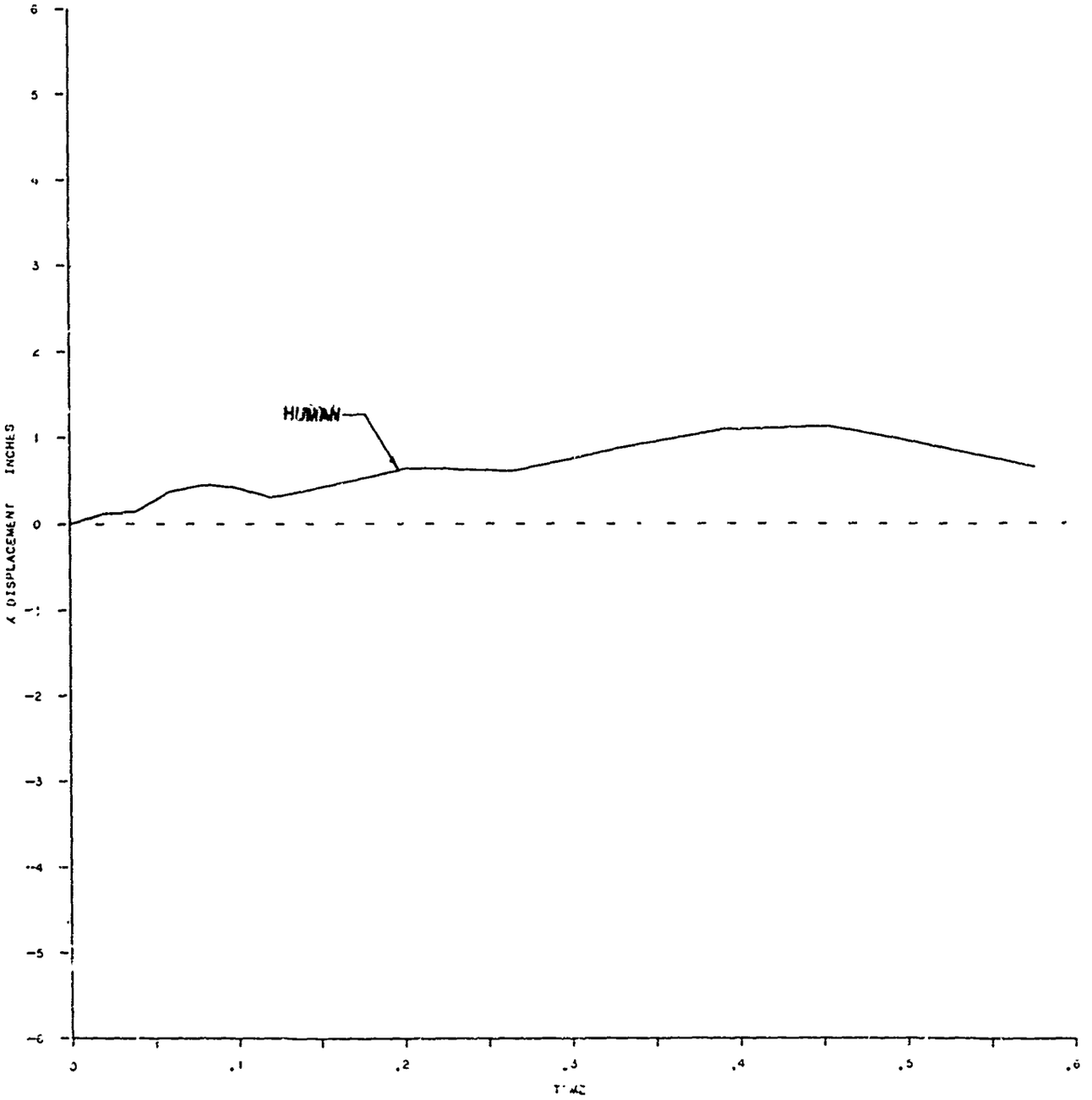
B

FIGURES 71 THRU 106

DATA PLOTS OF D. BRICE AND 50 PERCENTILE DUMMY

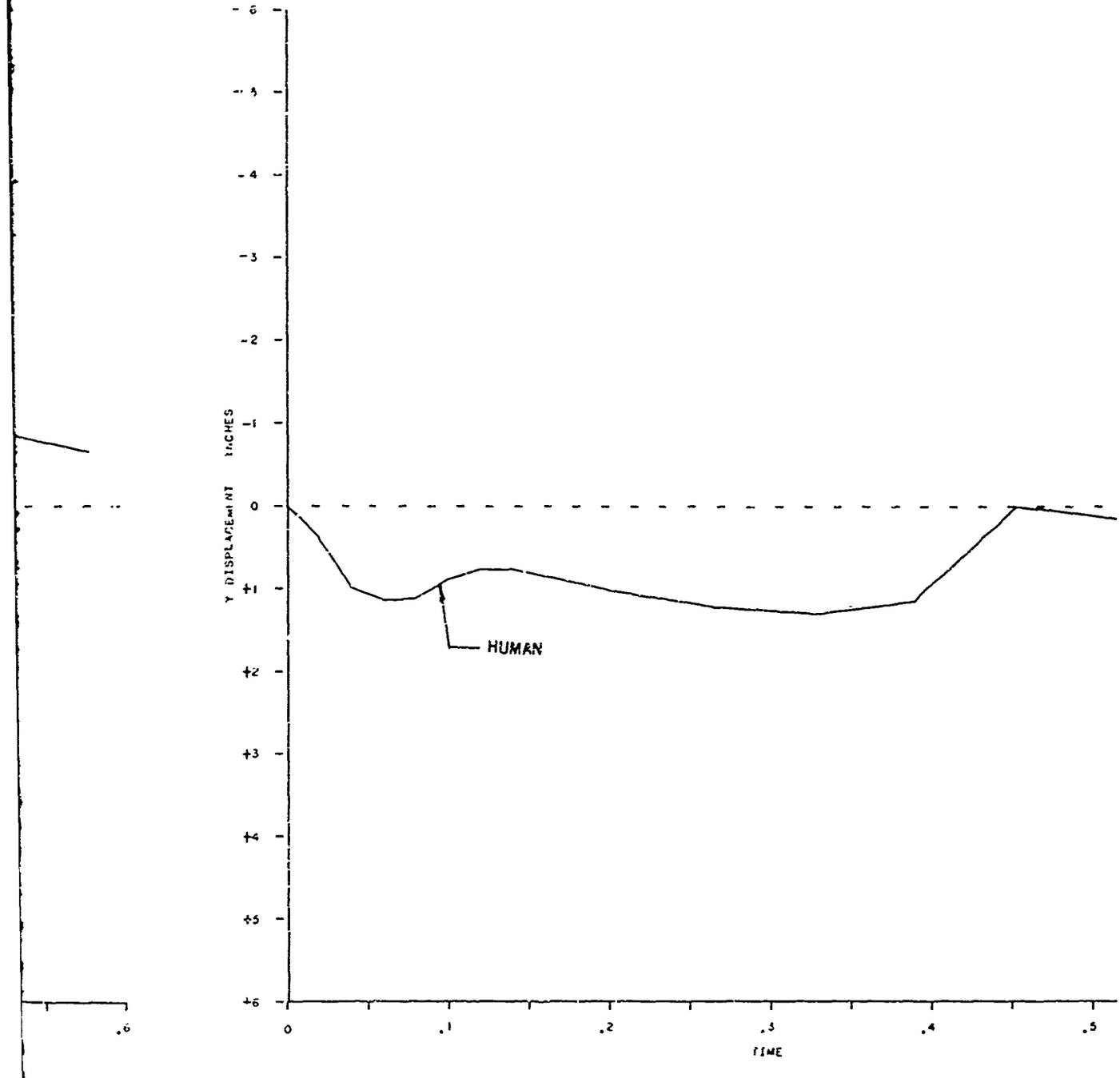
TEST NO.	G LEVEL	IMPACT VELOCITY
36	4.9	44 FPS
37	7.1	44 FPS
45	9.0	33 FPS
46	10.0	33 FPS

SUBJECTS - BRICE &
TEMPLE POINT - TEST



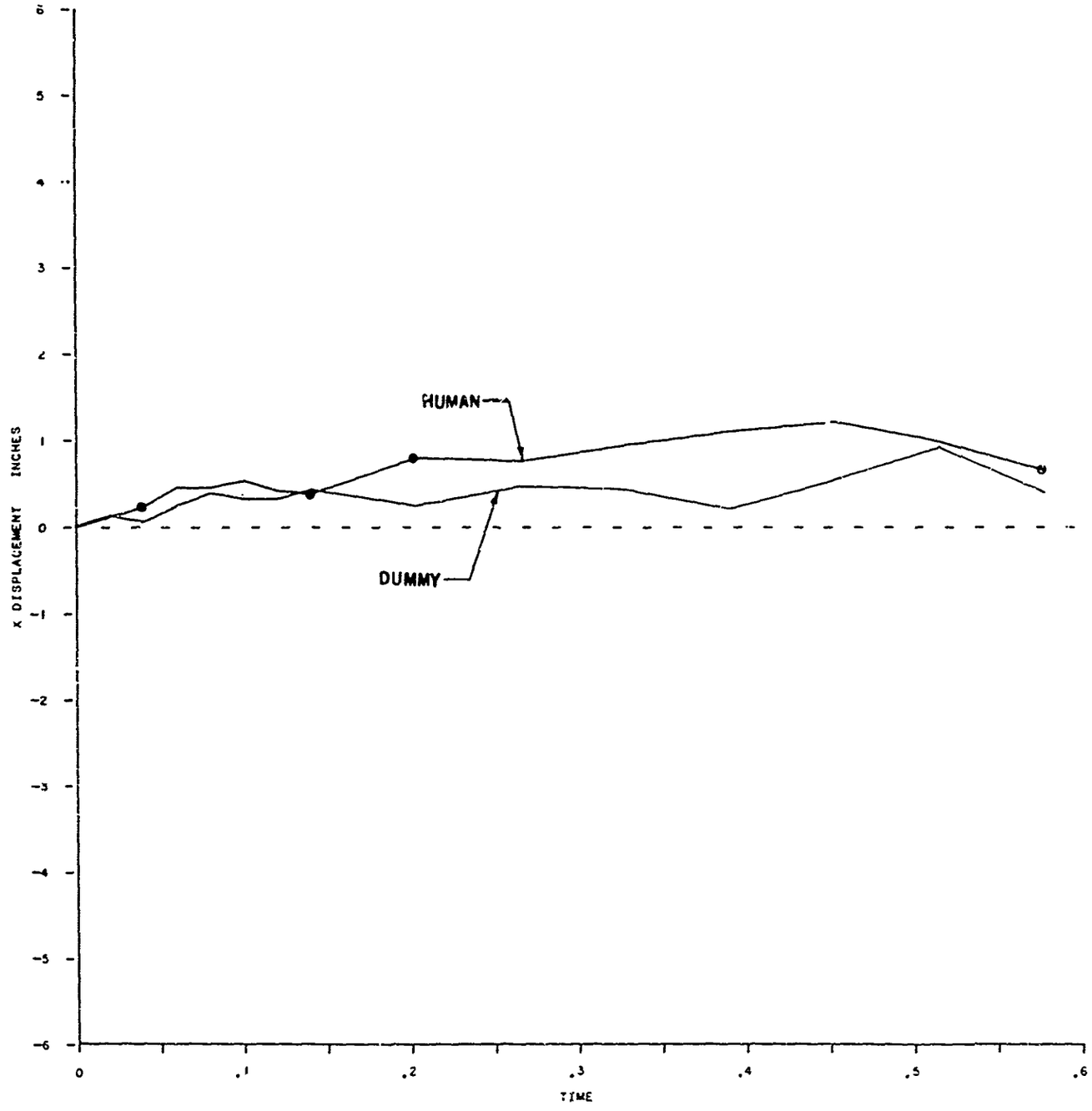
A

BRICE & 50%TILE DUMMY
T - TEST NO. 36 - 4.9 G



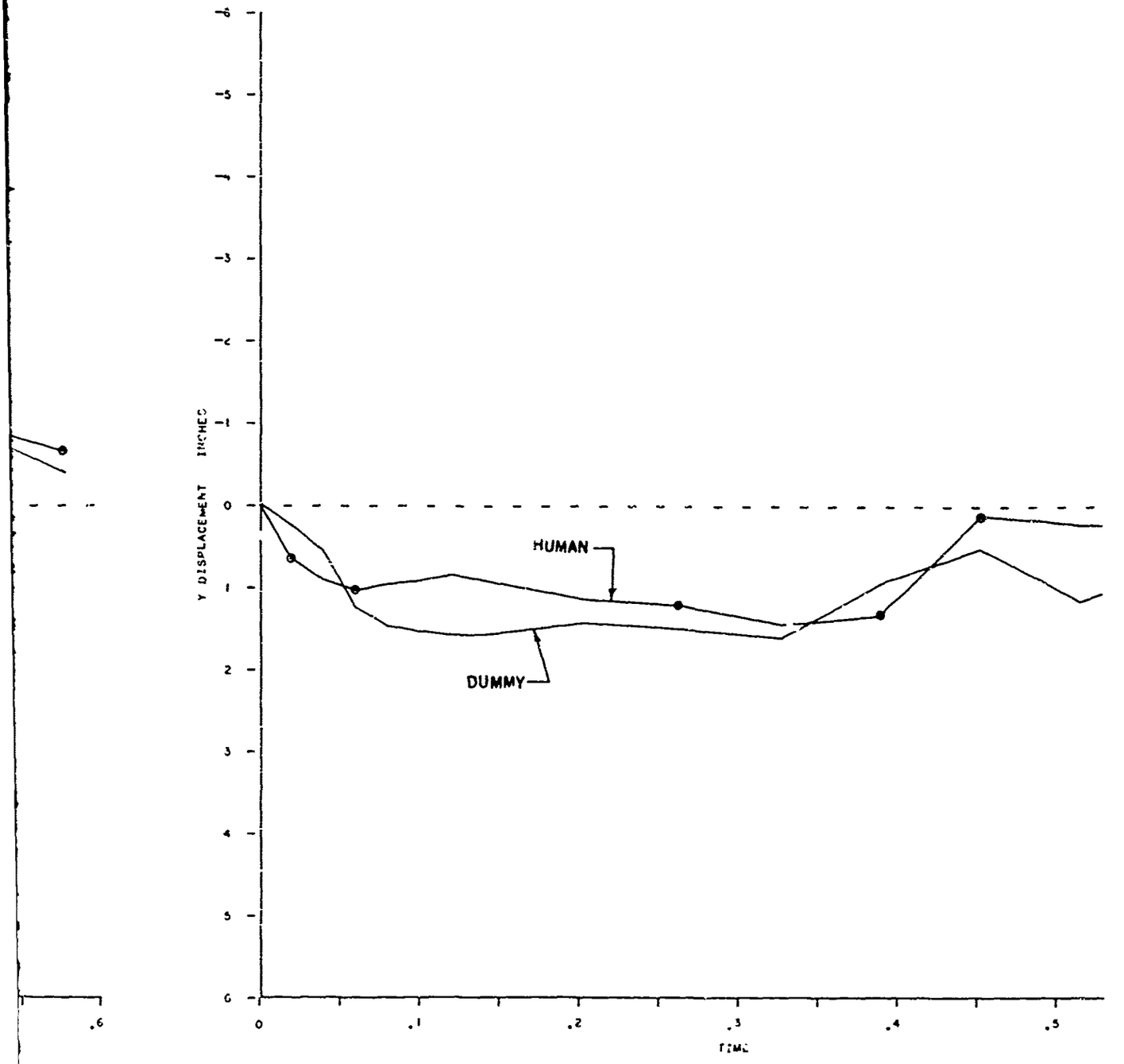
B

SUBJECTS - BRICE &
EYE POINT - TEST N



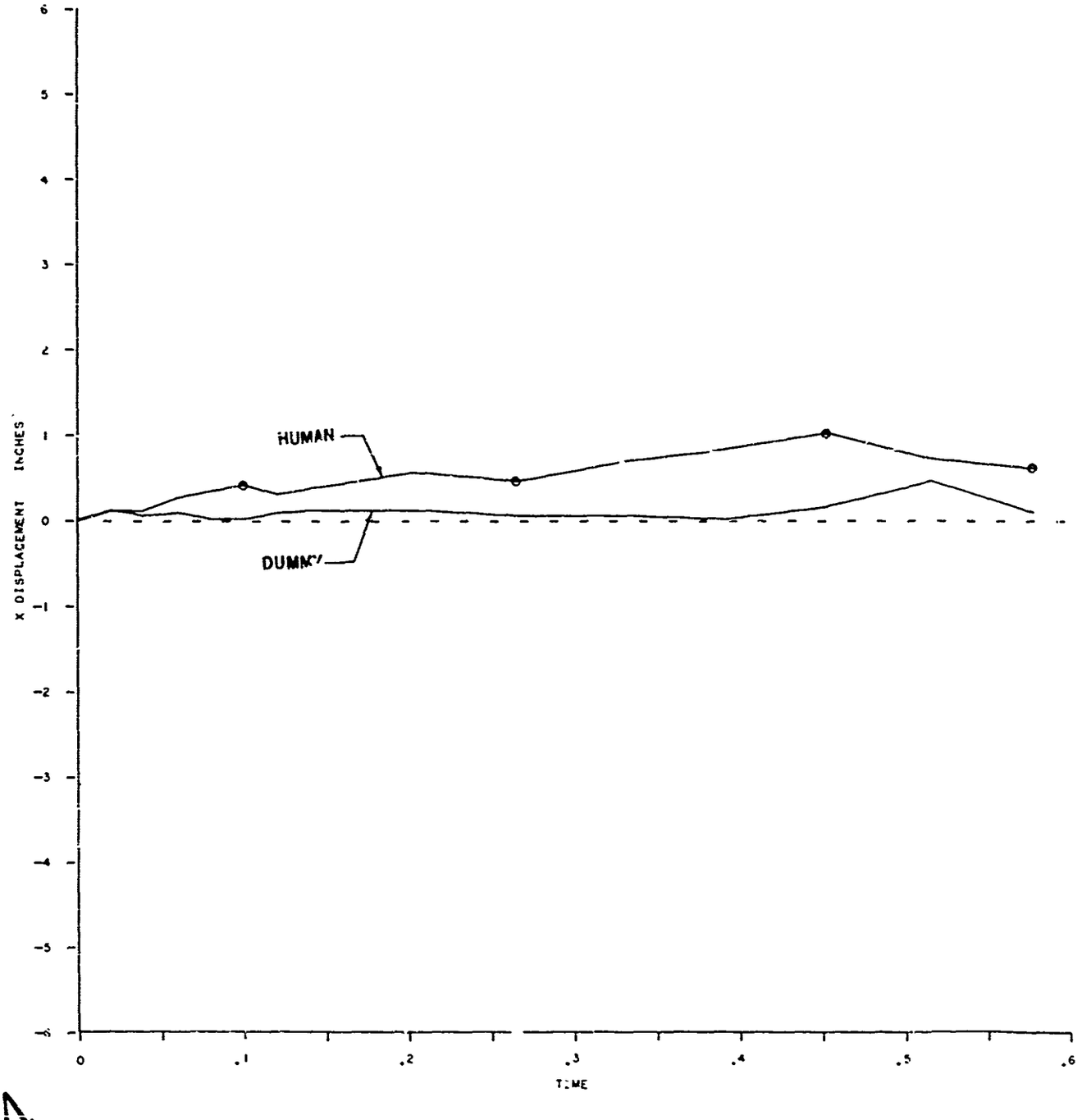
A

RICE & 50%TILE DUMMY
TEST NO. 36 - 4.9 G

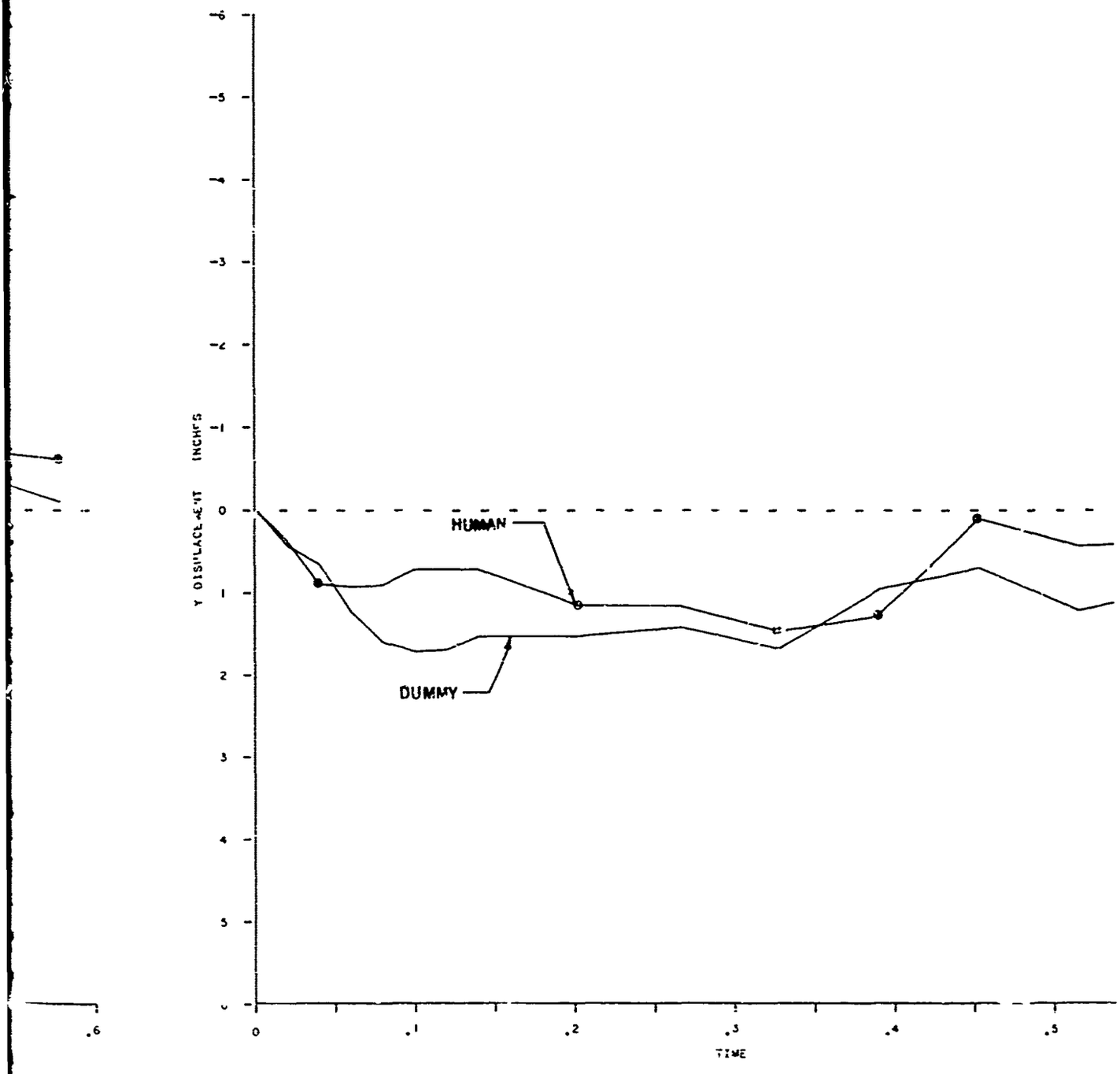


B

SUBJECTS - BRICE
NOSE POINT - TI

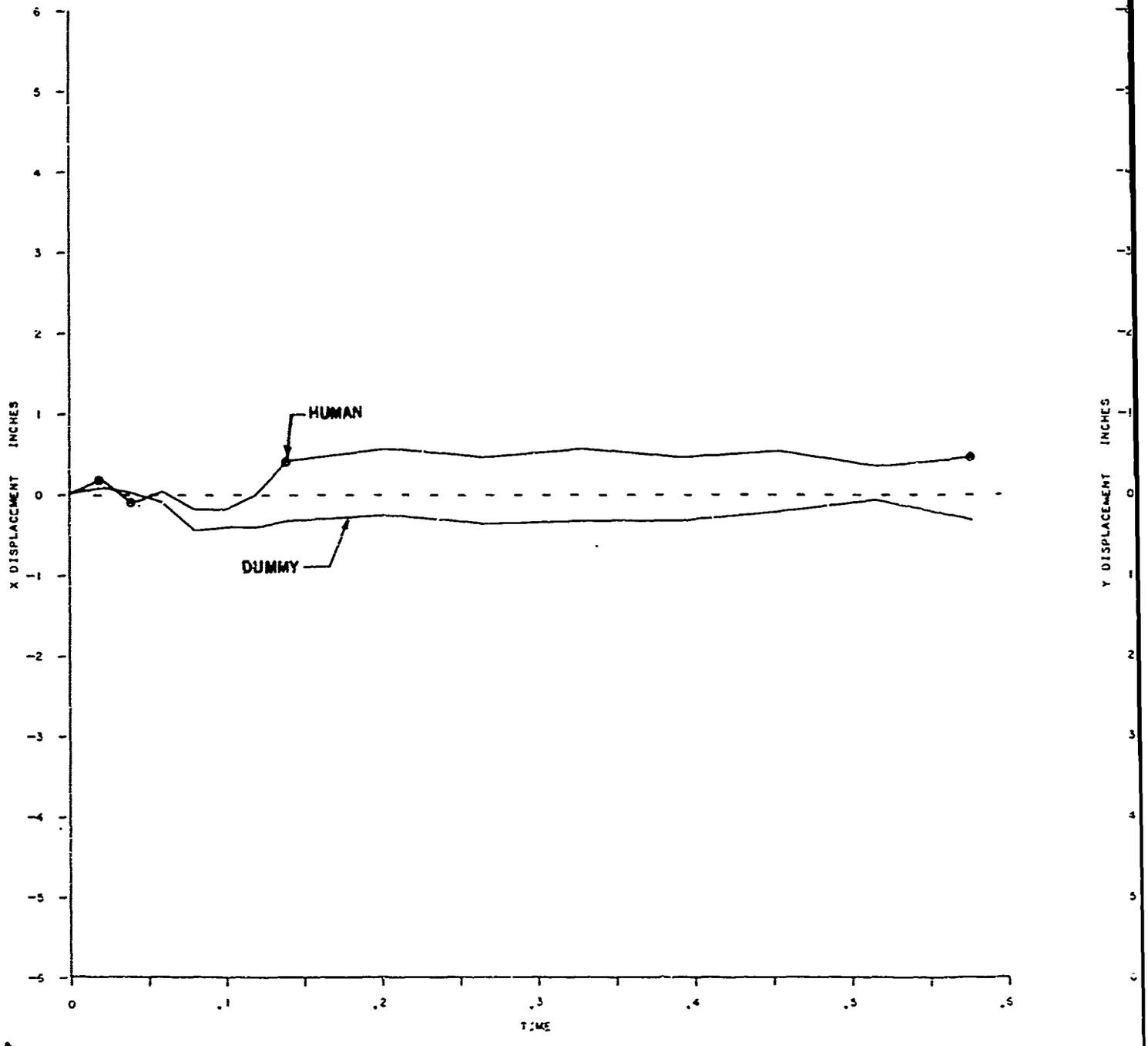


BRICE & 50%TILE DUMMY
NT - TEST NO. 36 - 4.9 G

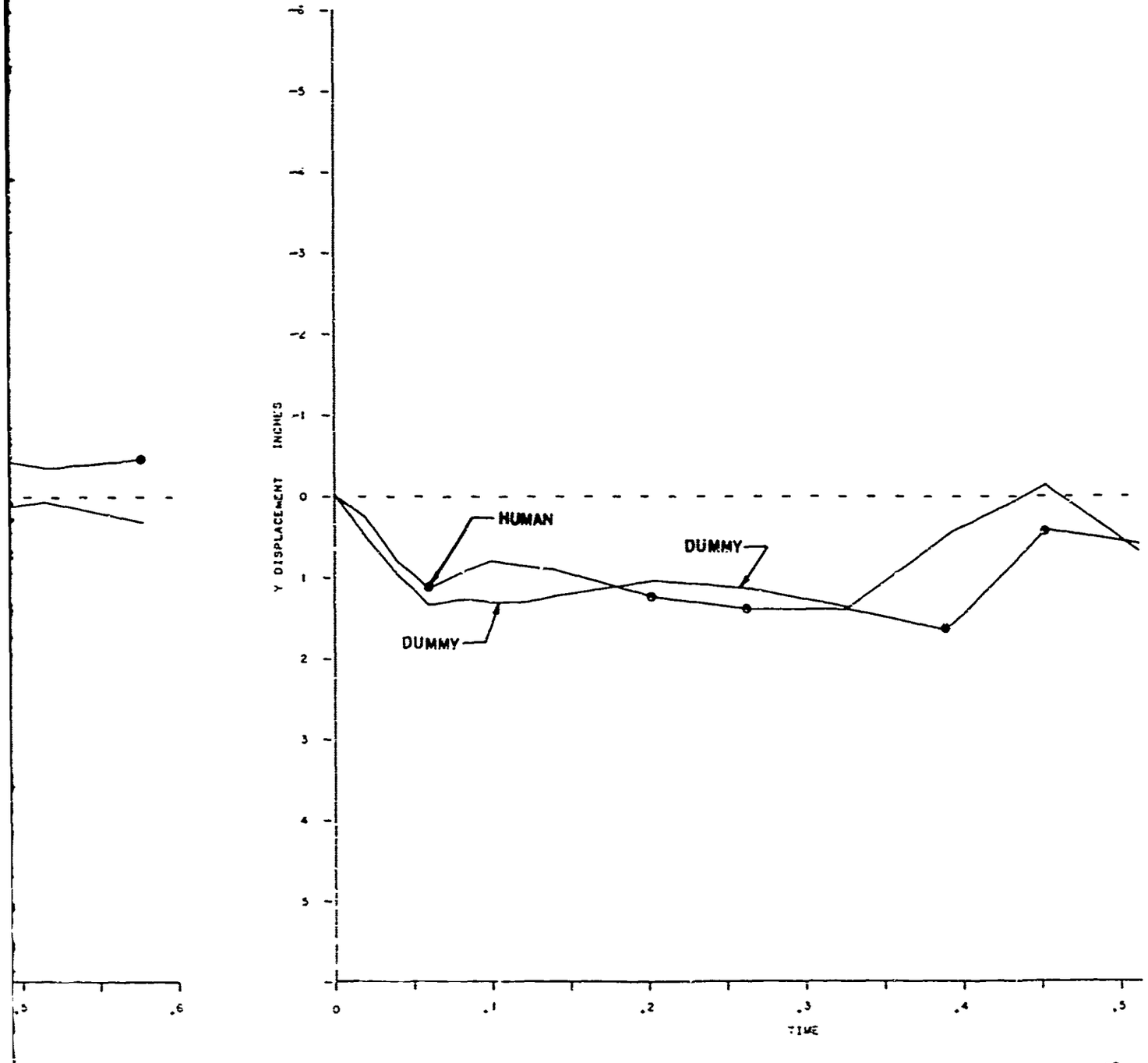


B

SUBJECTS - BRICE & 5
SHOULDER POINT - TES

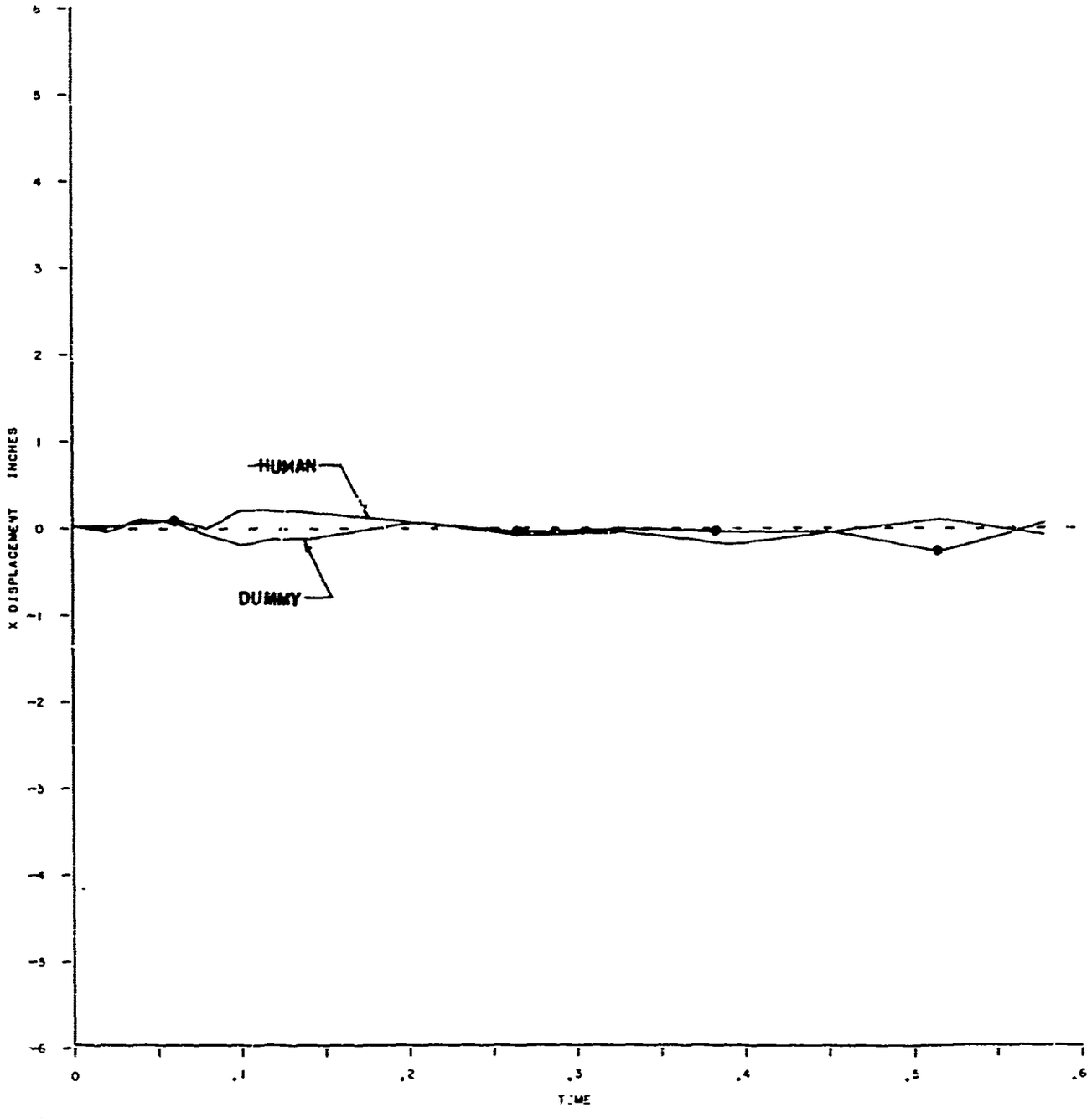


- BRICE & 50%TILE DUMMY
POINT - TEST NO. 36 - 4.9 G

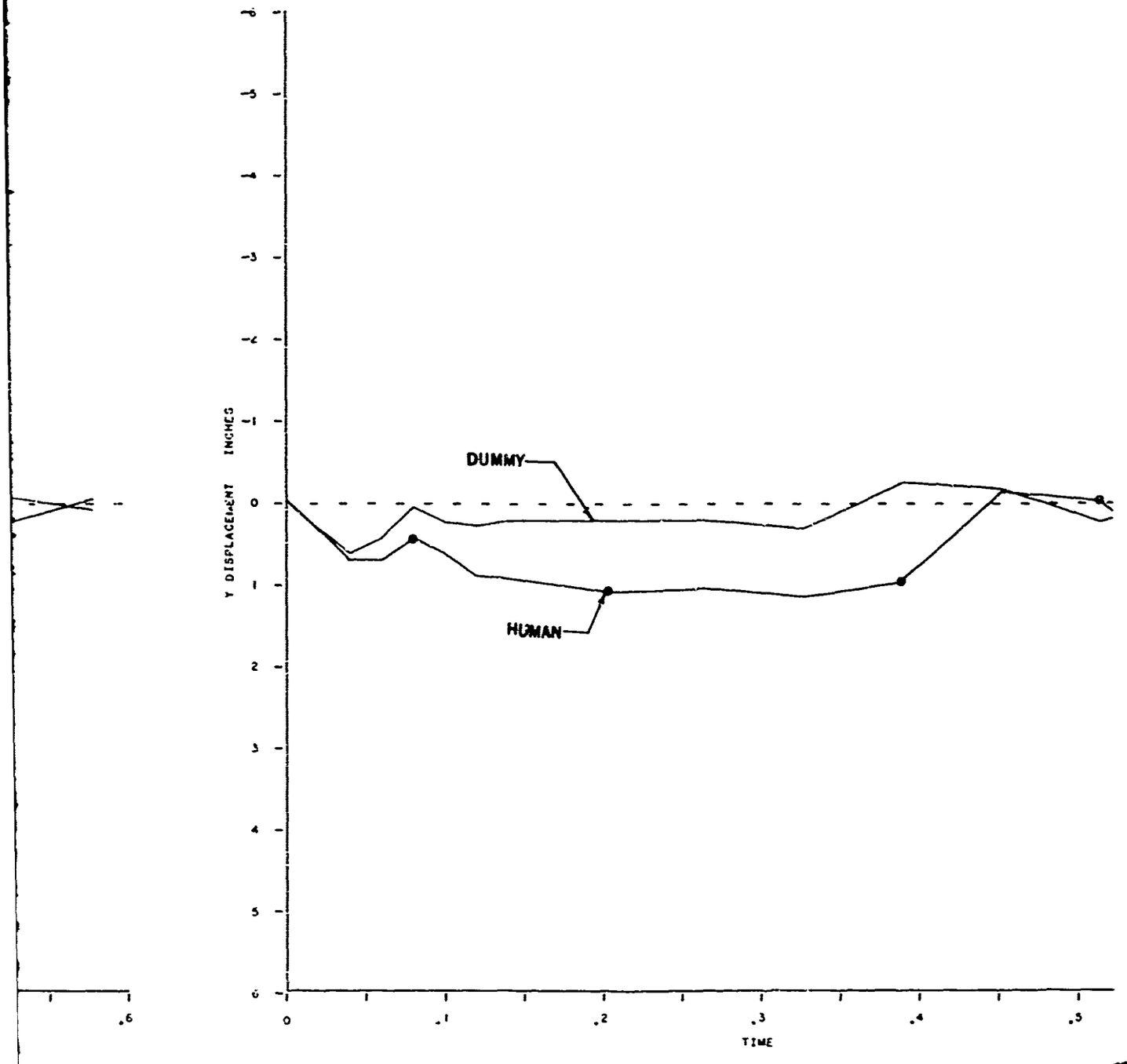


B

SUBJECTS - BRICE & 5
KNEE POINT - TEST

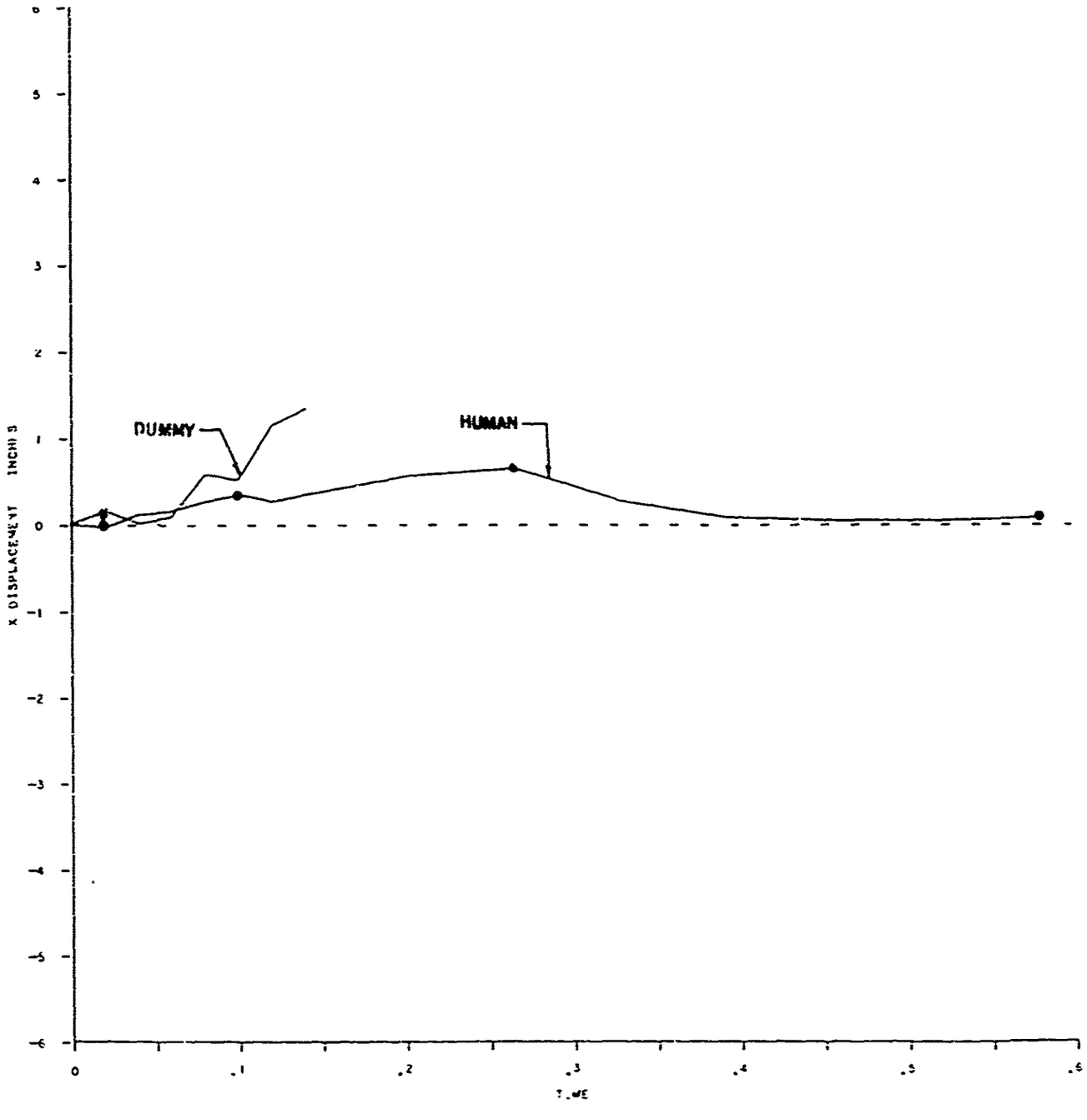


BRICE & 50%TILE DUMMY
NT - TEST NO. 36 - 4.9 G

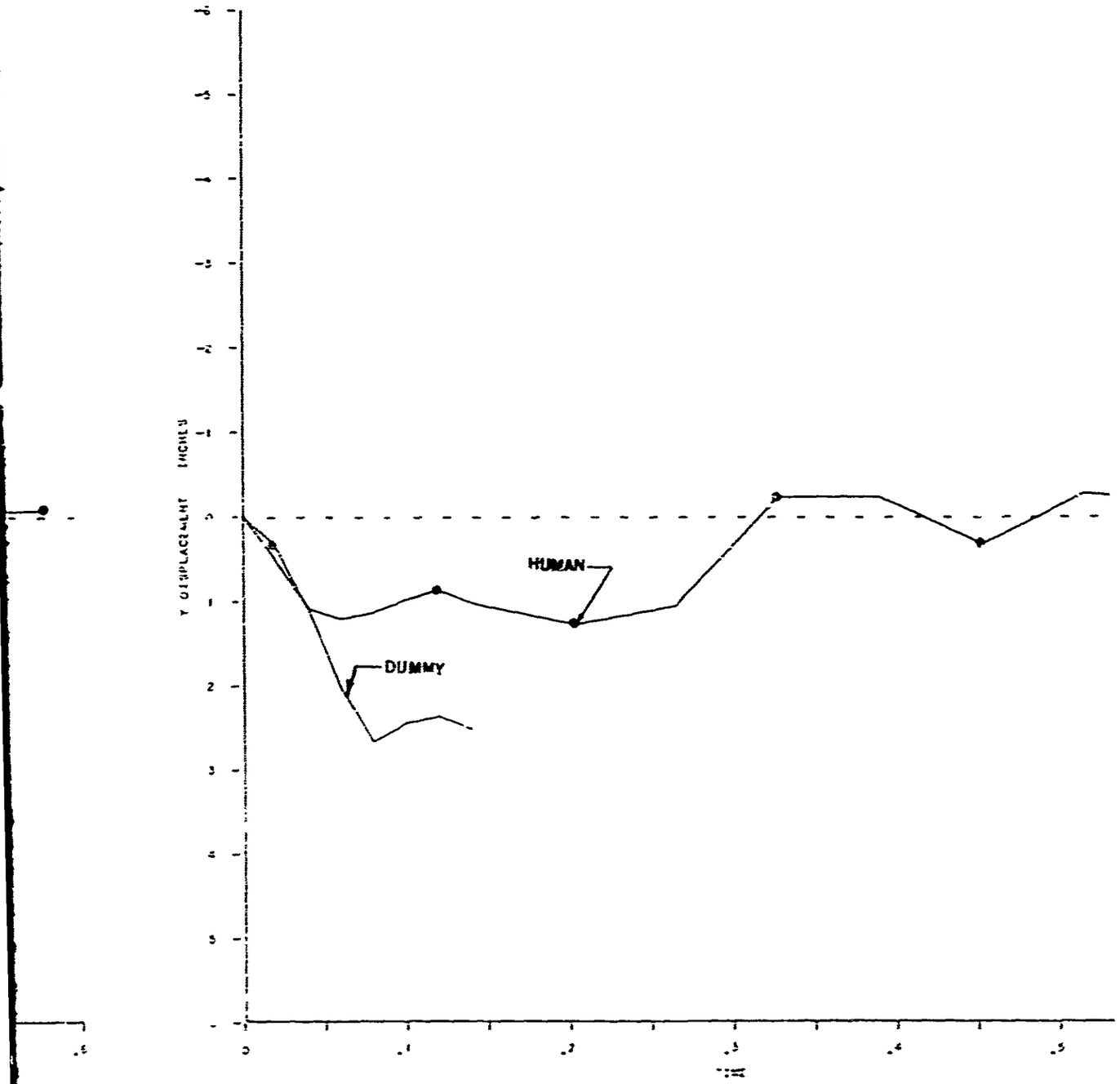


B

SUBJECTS - BRICE & 50
EYE POINT - TEST NO

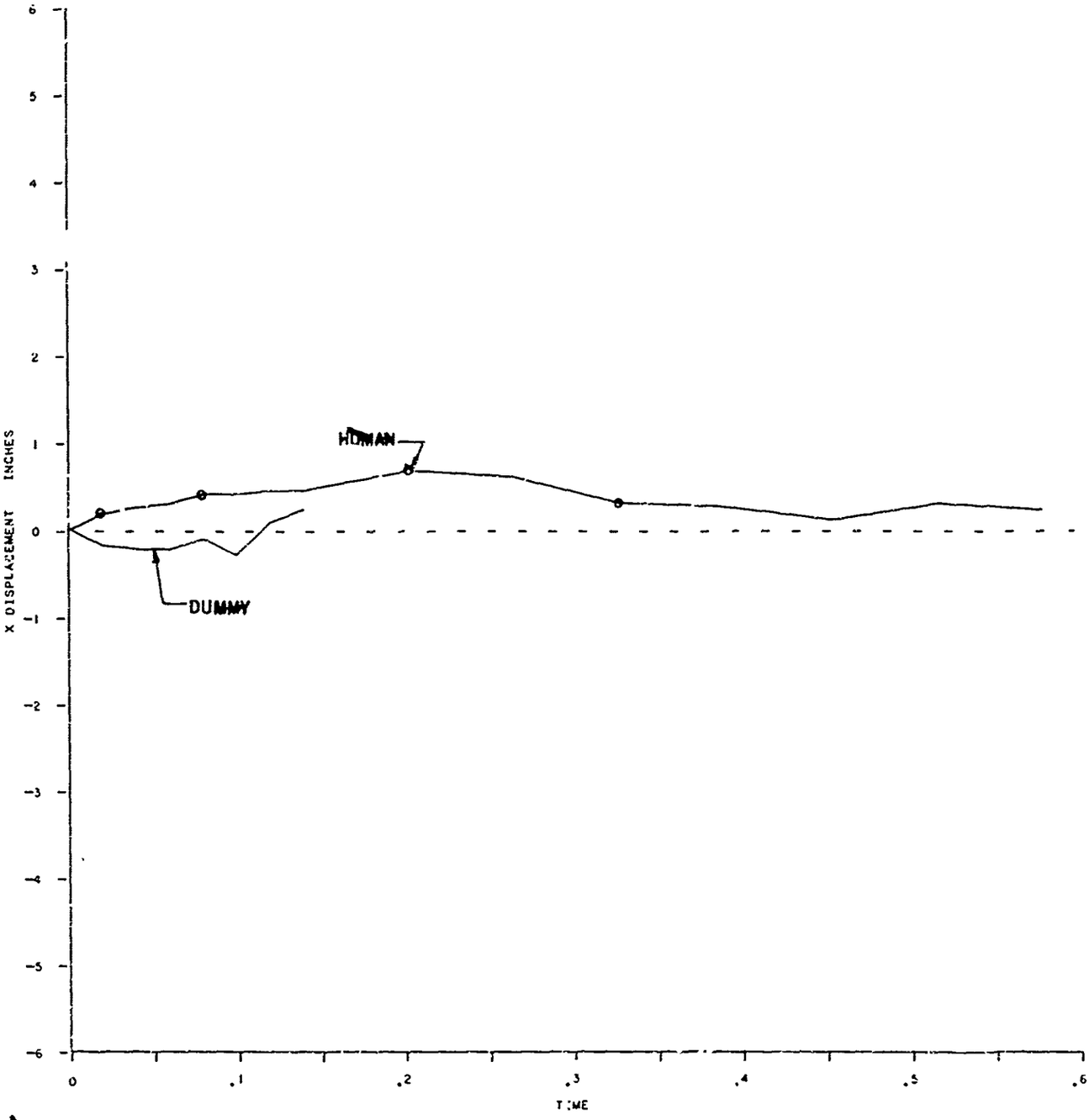


RICE & 50%TILE DUMMY
TEST NO. 37 - 7.1 G



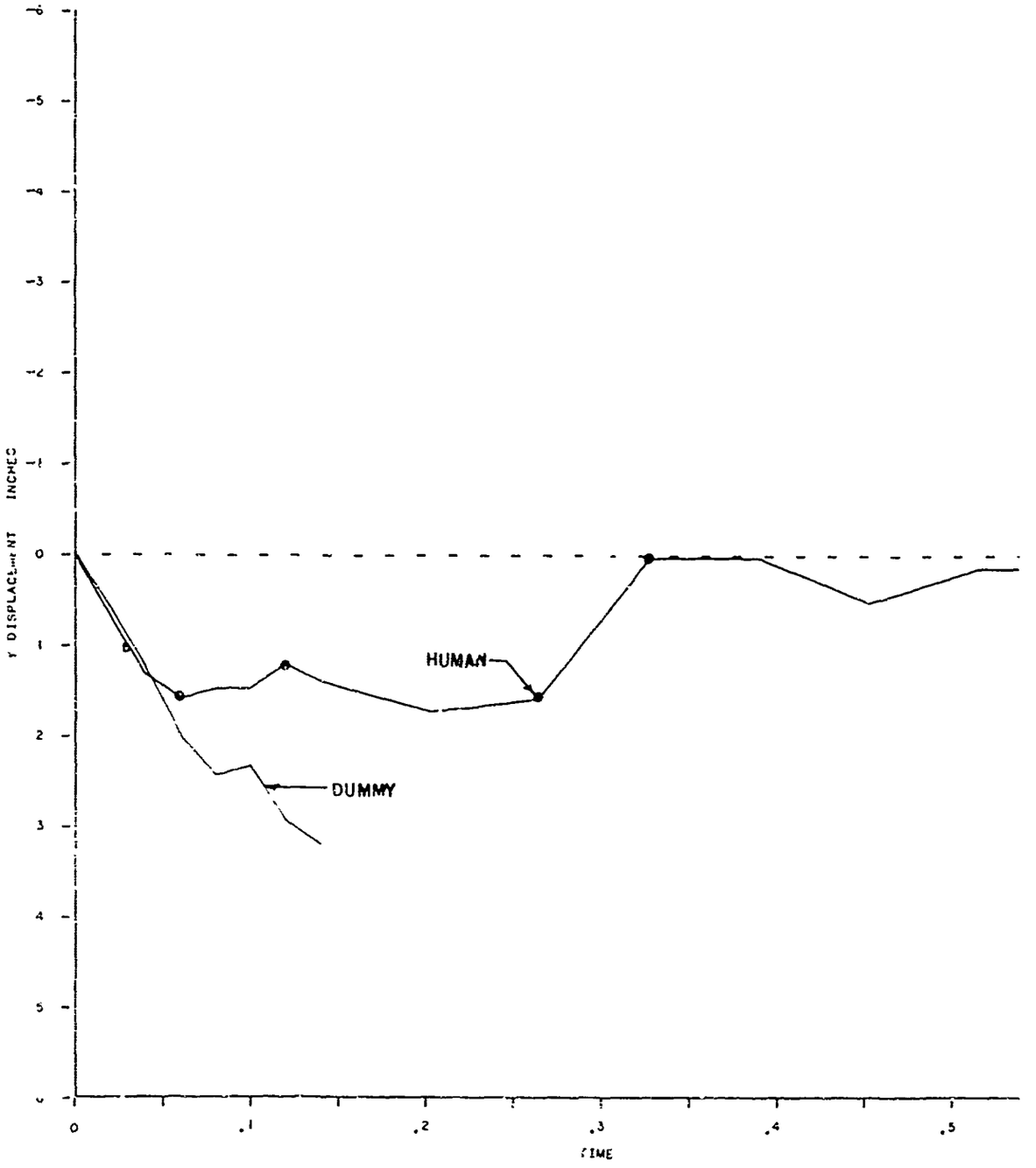
B

SUBJECTS - BRICE -
NOSE POINT - TEST



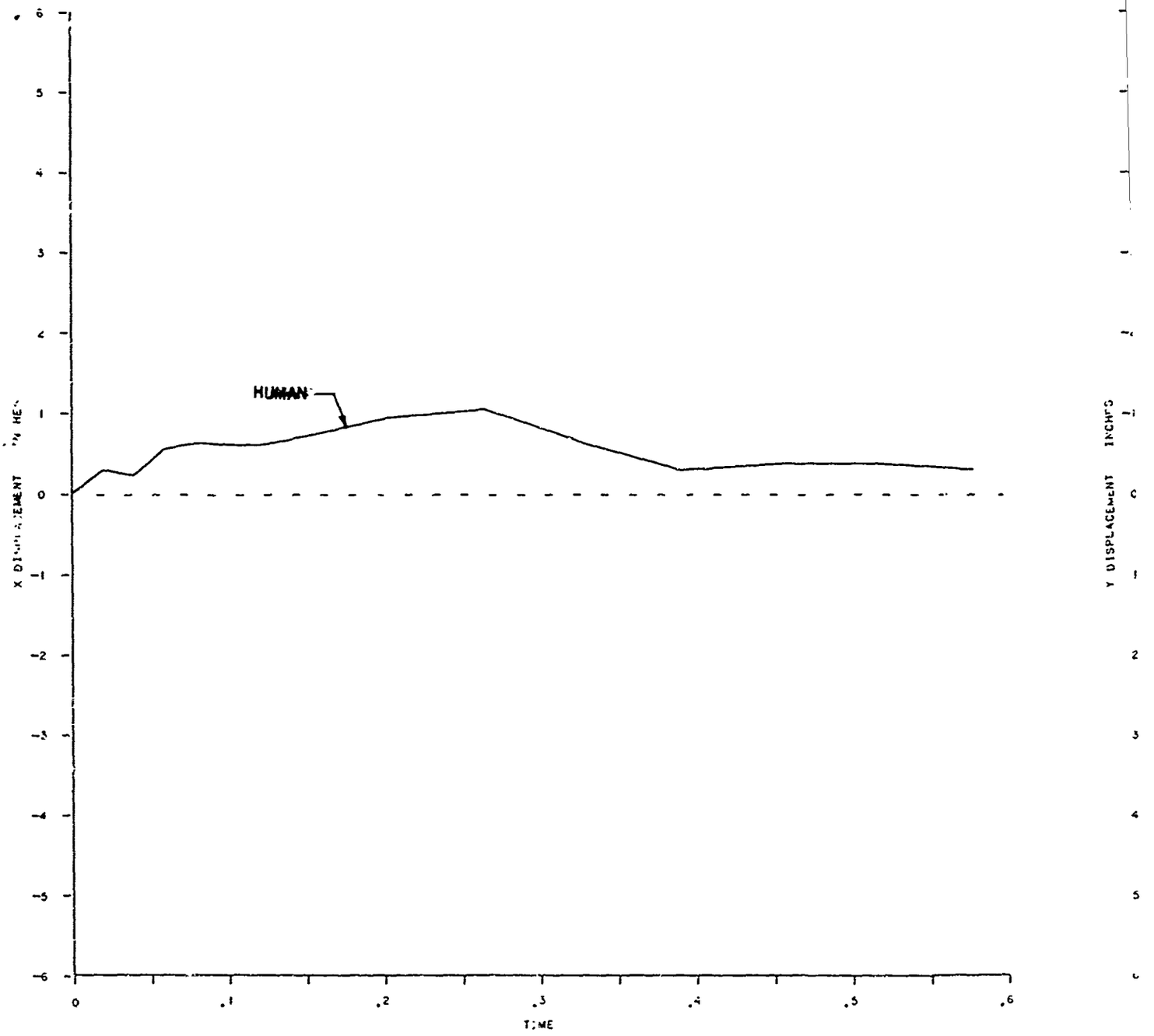
A

BRICE - 50%TILE DUMMY
NT - TEST NO. 37 - 7.1 G

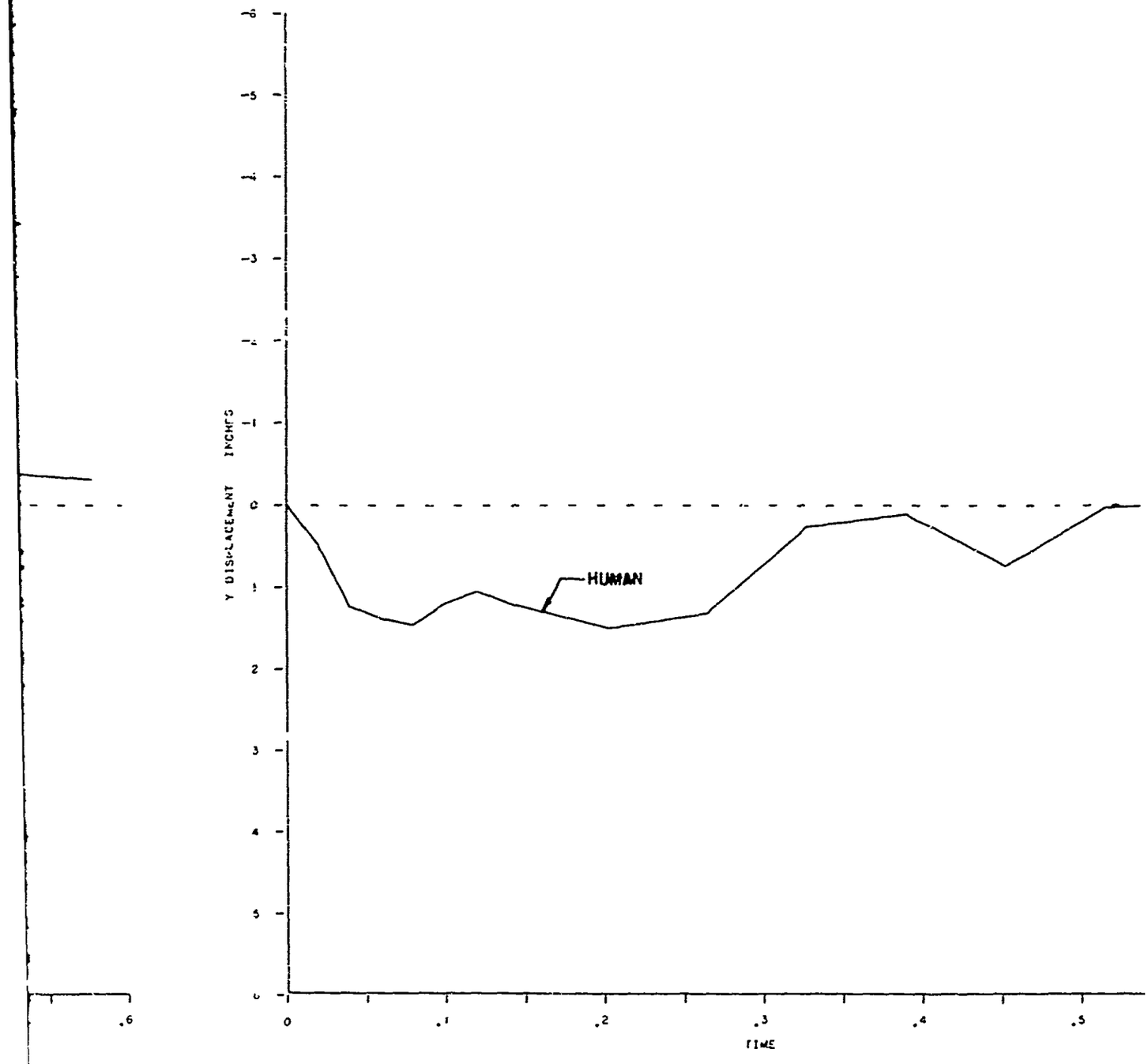


B

SUBJECTS BRICE & 50
TEMPLE POINT - TEST

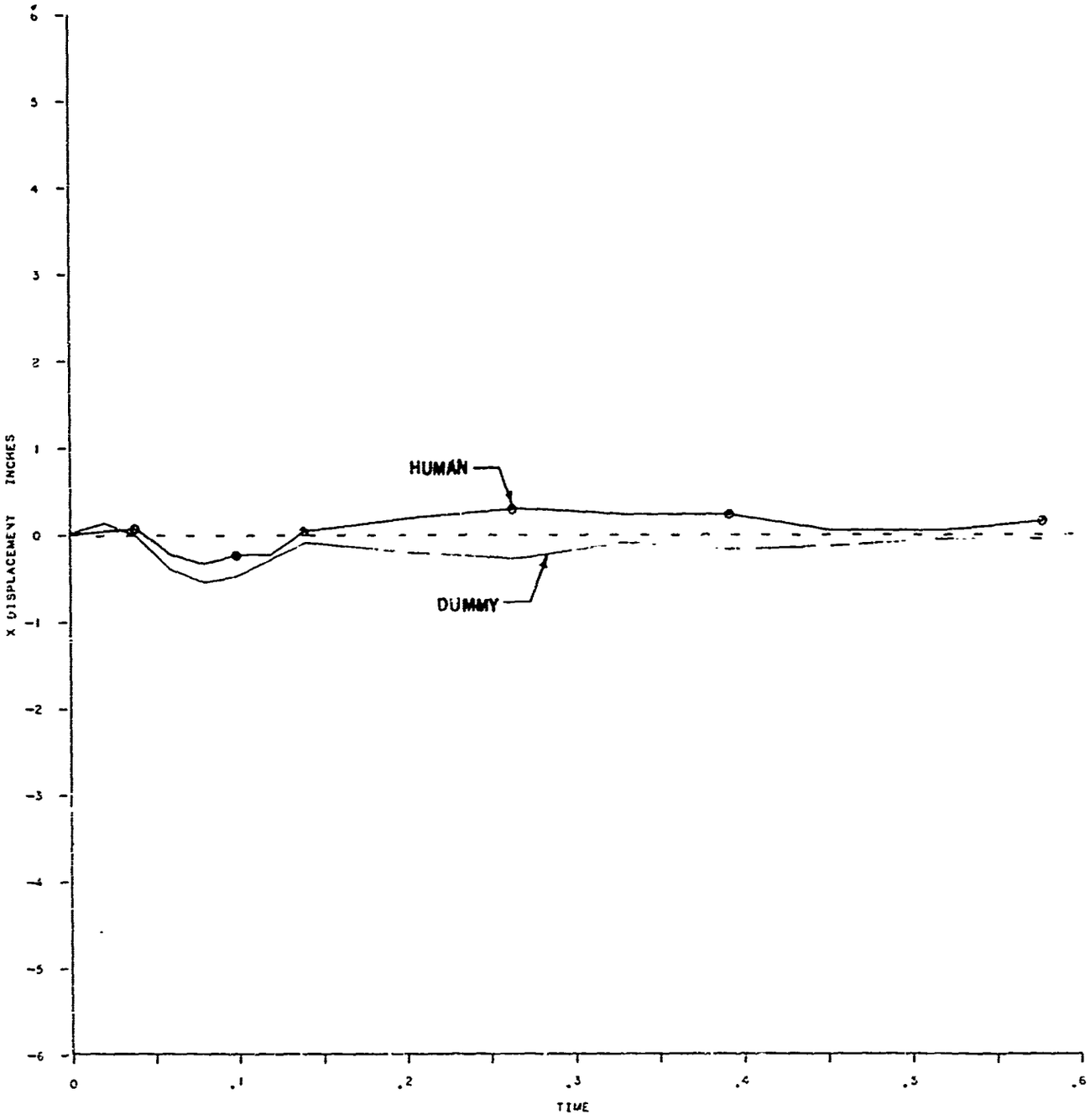


BRICE & 50%TILE DUMMY
NT - TEST NO. 37 - 7.1 G

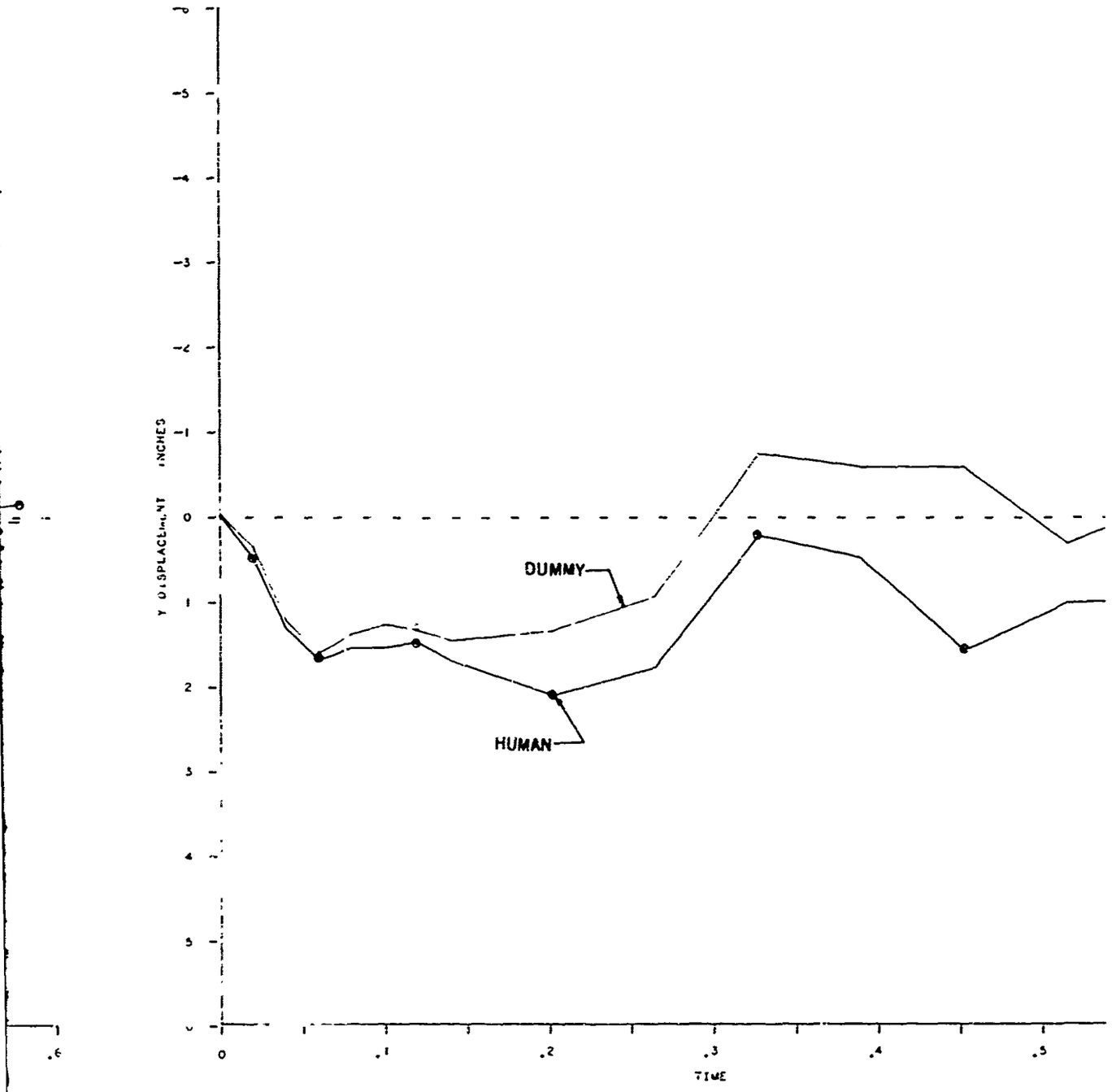


B

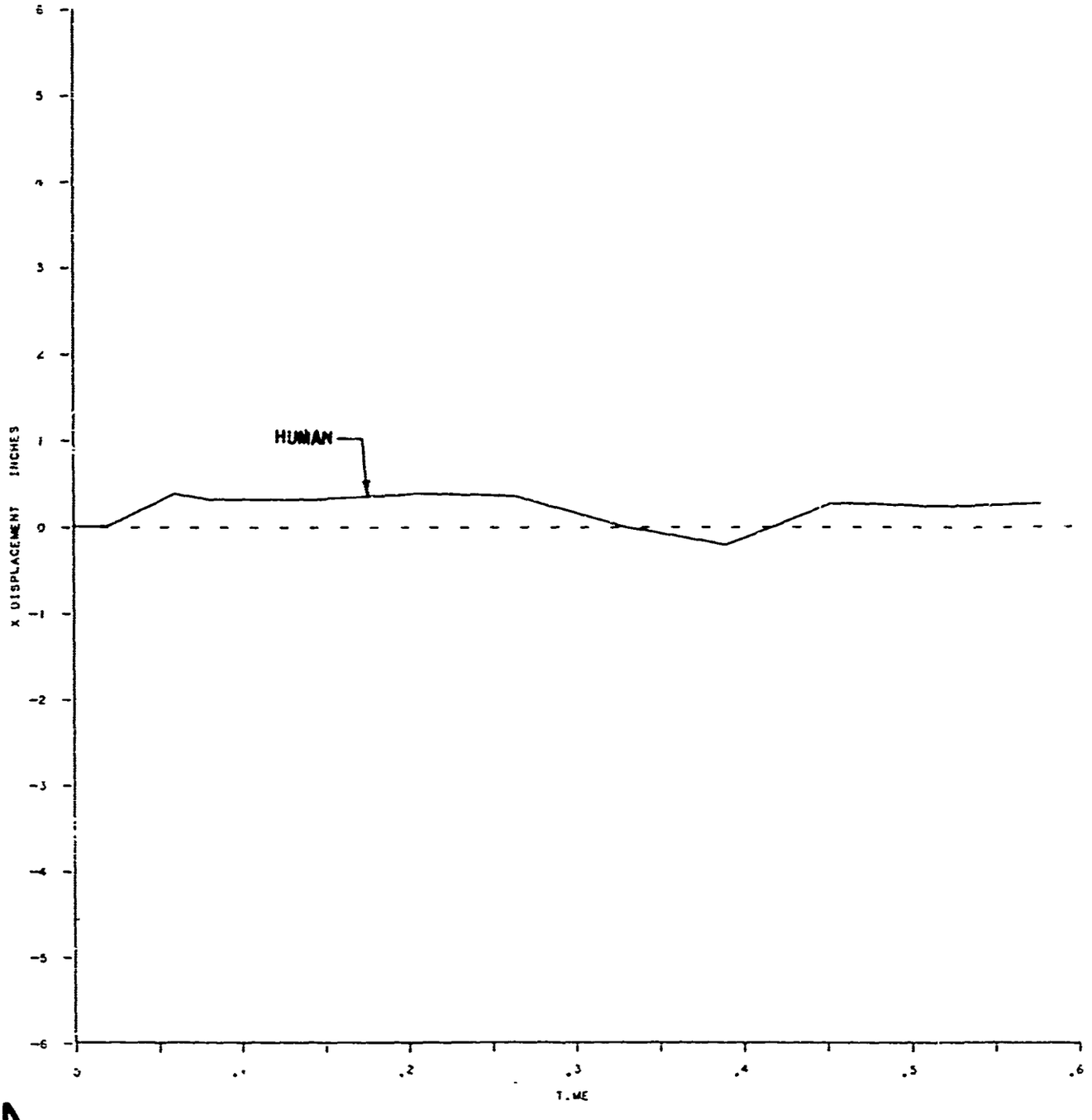
SUBJECTS - BRICE &
SHOULDER POINT - TE



RICE & 50%TILE DUMMY
NT - TEST NO. 37 - 7.1 G

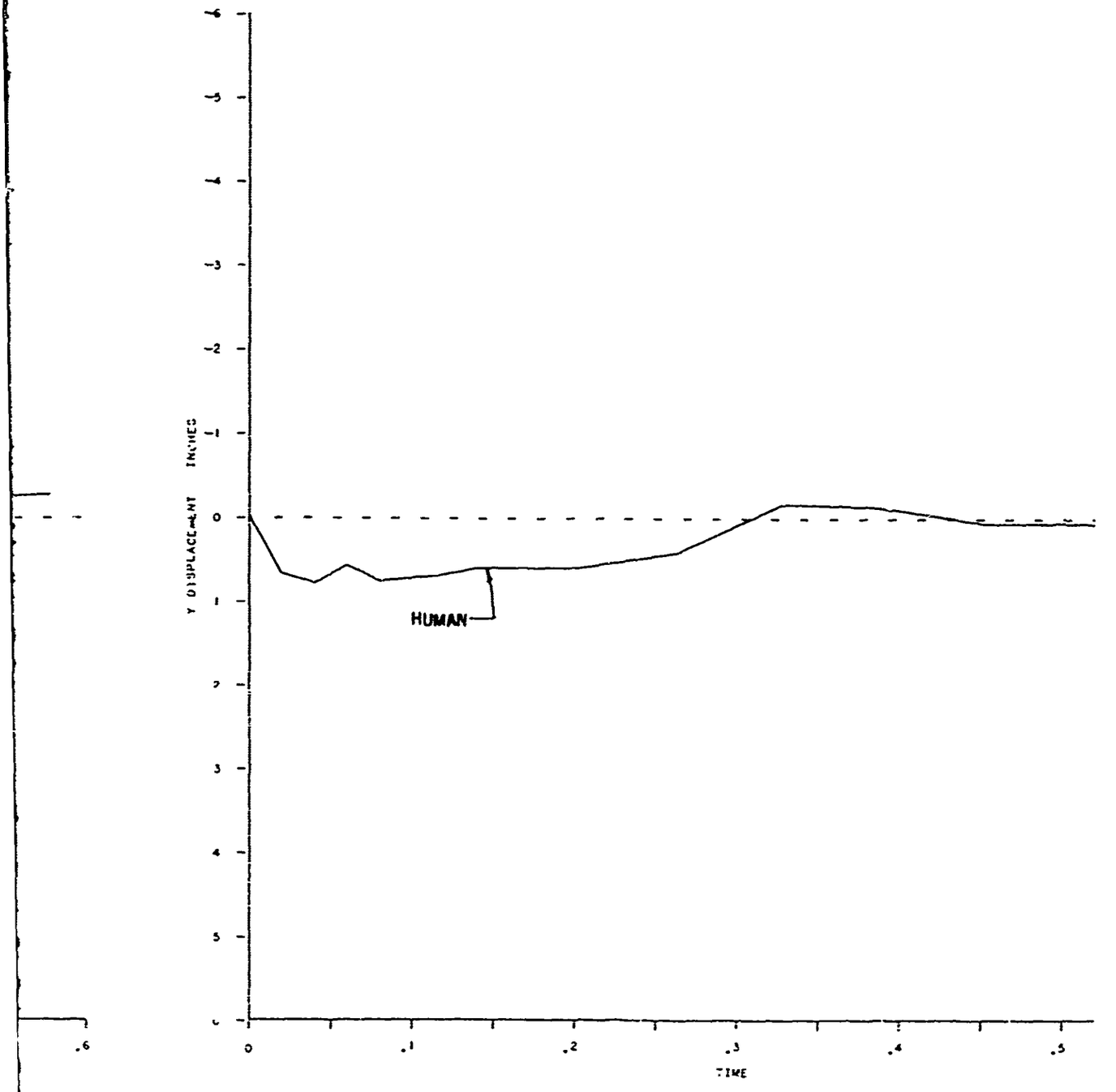


SUBJECTS - BRICE & 5
THIGH POINT - TEST



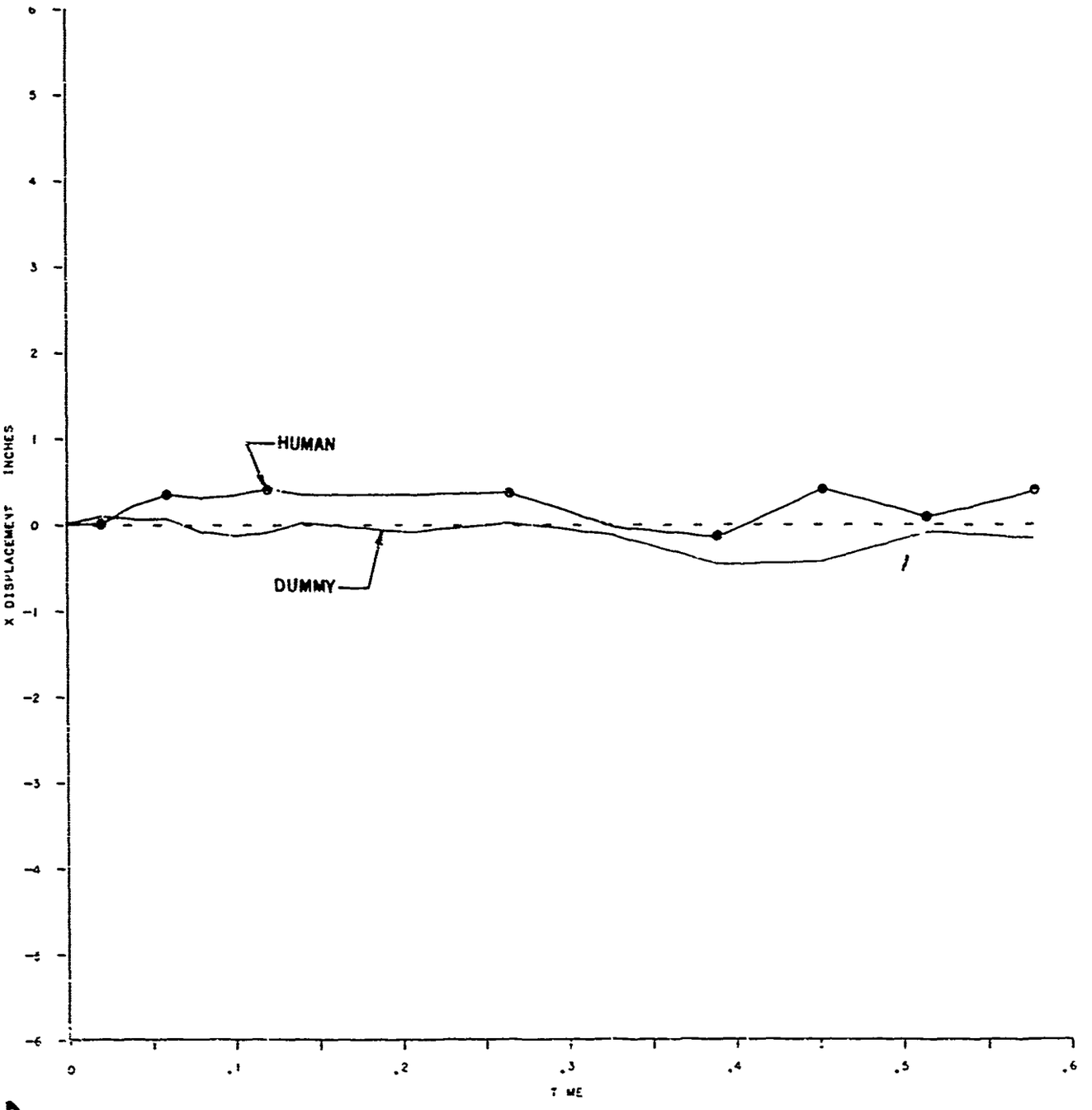
A

RICE & 50%TILE DUMMY
- TEST NO. 37 - 7.1 G



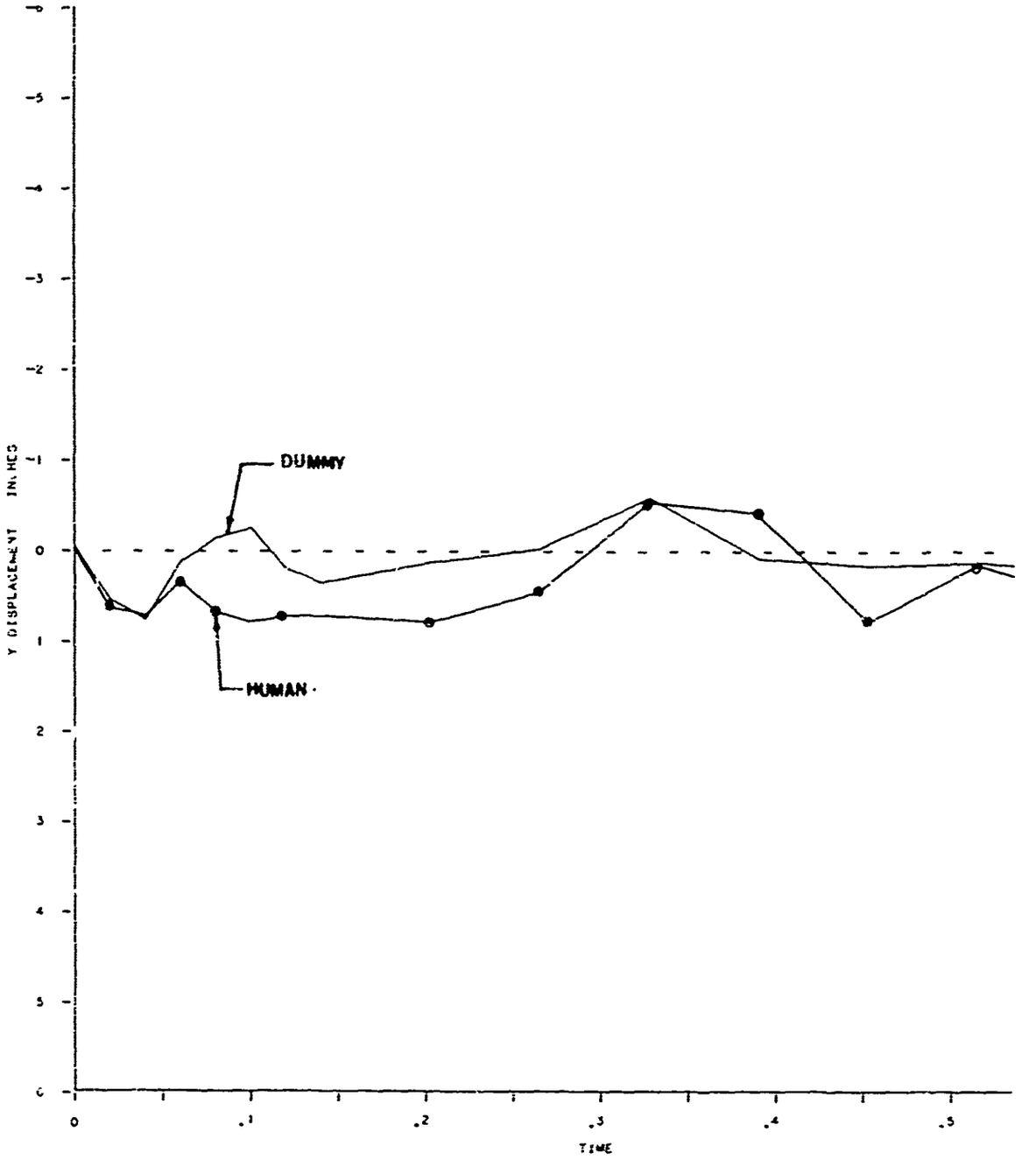
B

SUBJECTS - BRICE &
KNEE POINT - TEST



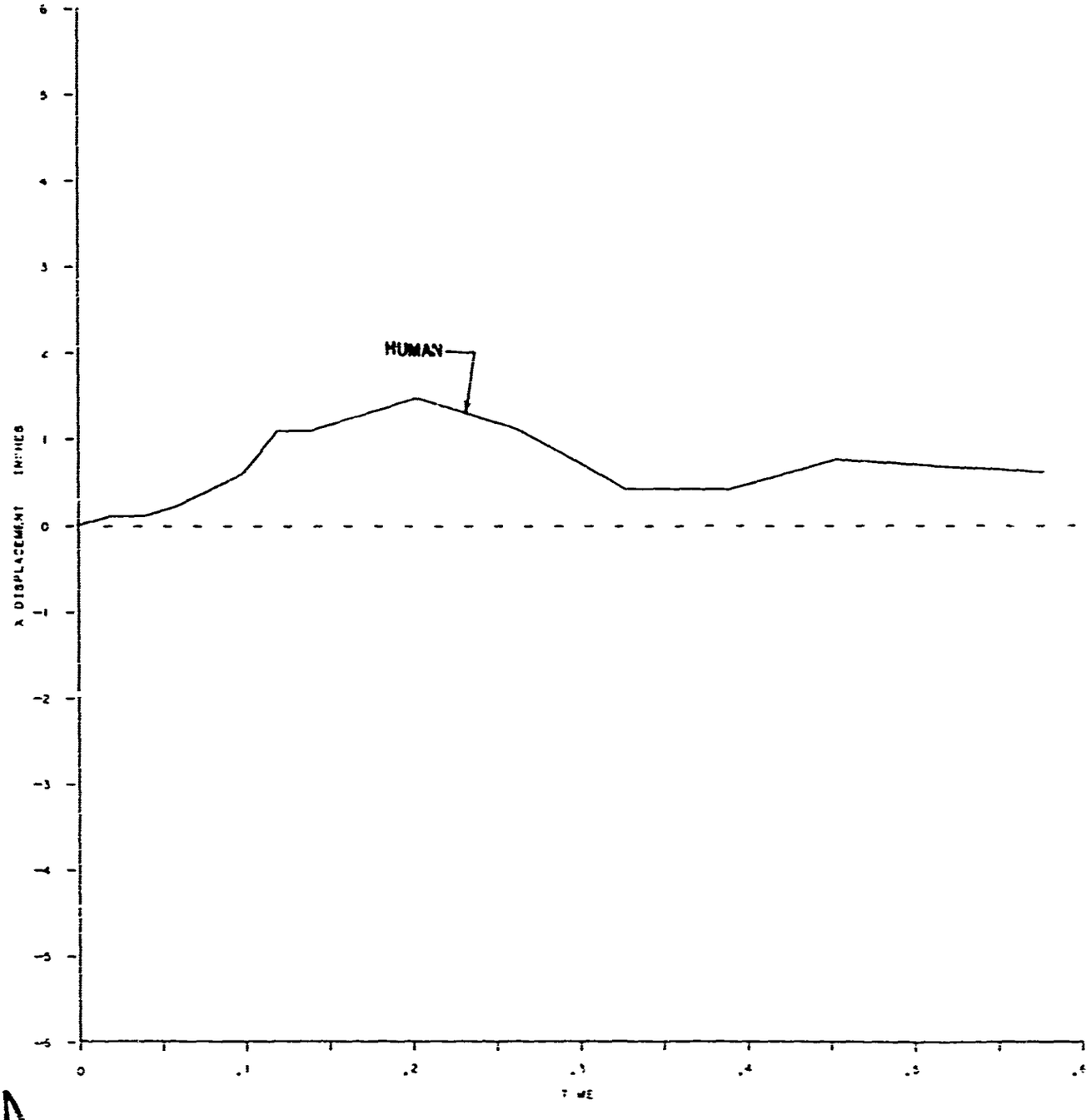
A

BRICE & 50%TILE DUMMY
INT - TEST NO. 37 - 7.1G



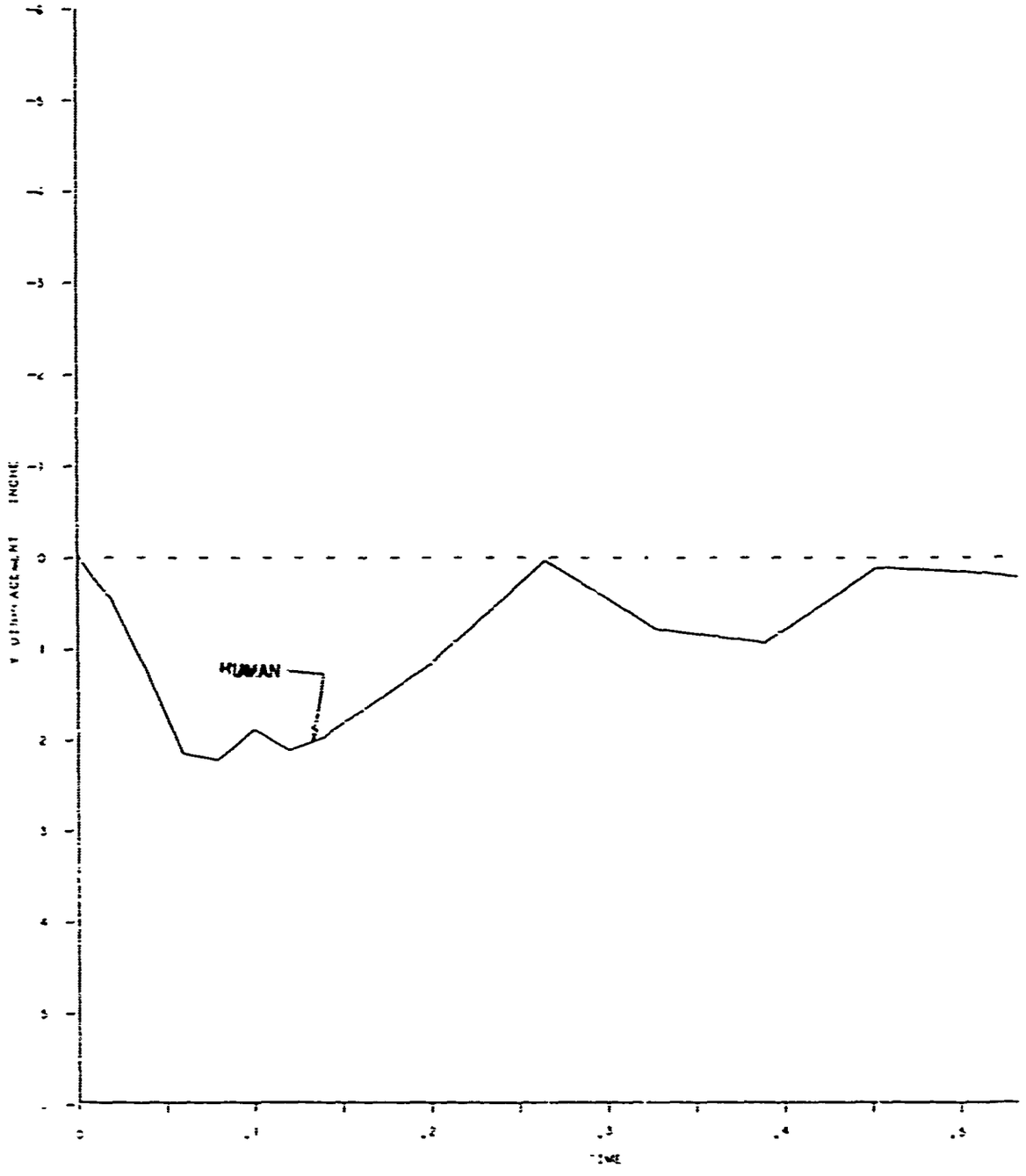
B

SUBJECTS - BRICE
NOSE POINT - TE



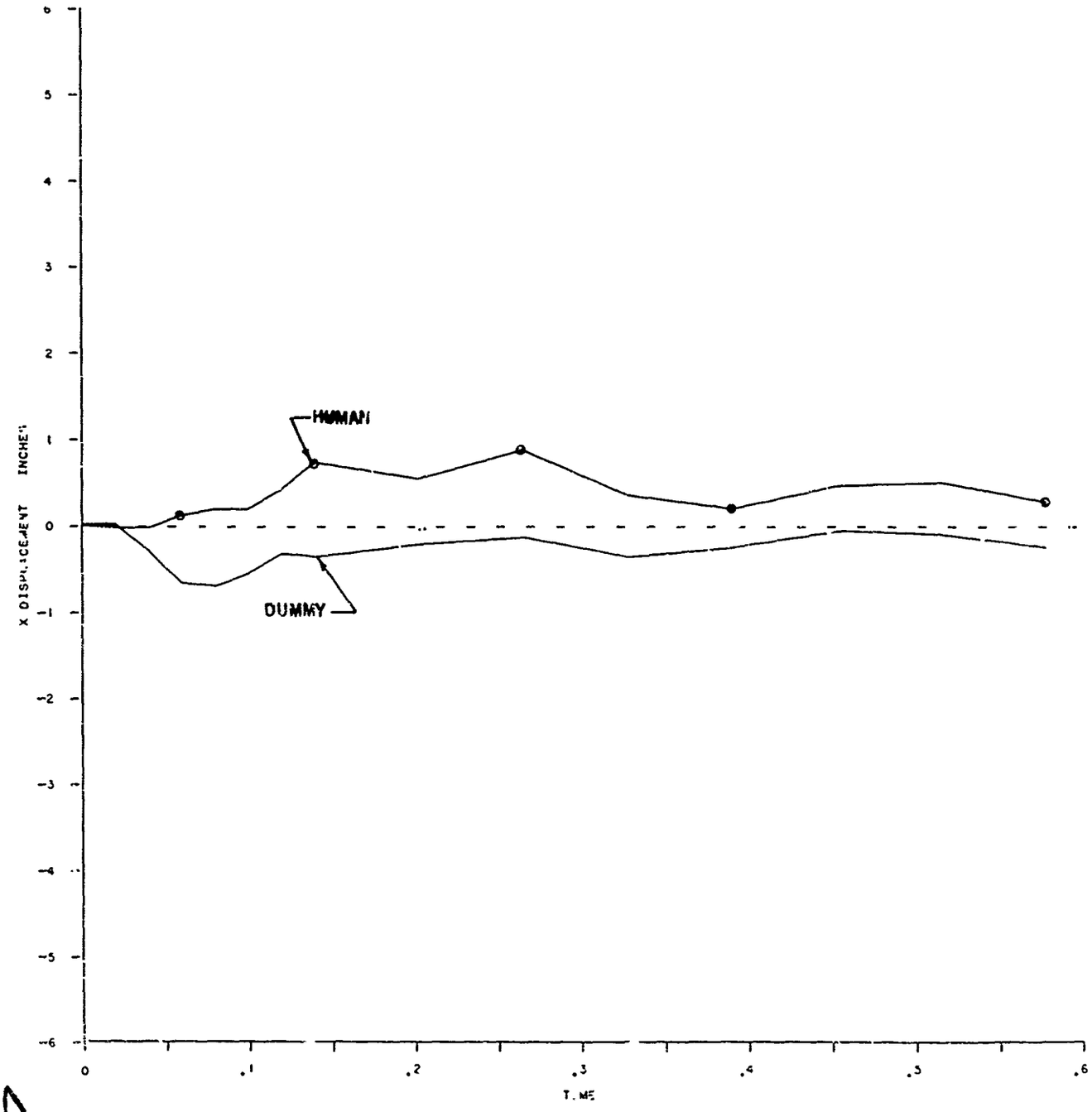
A

BRICE & 50%TILE DUMMY
T - TEST NO. 45 - 9 G



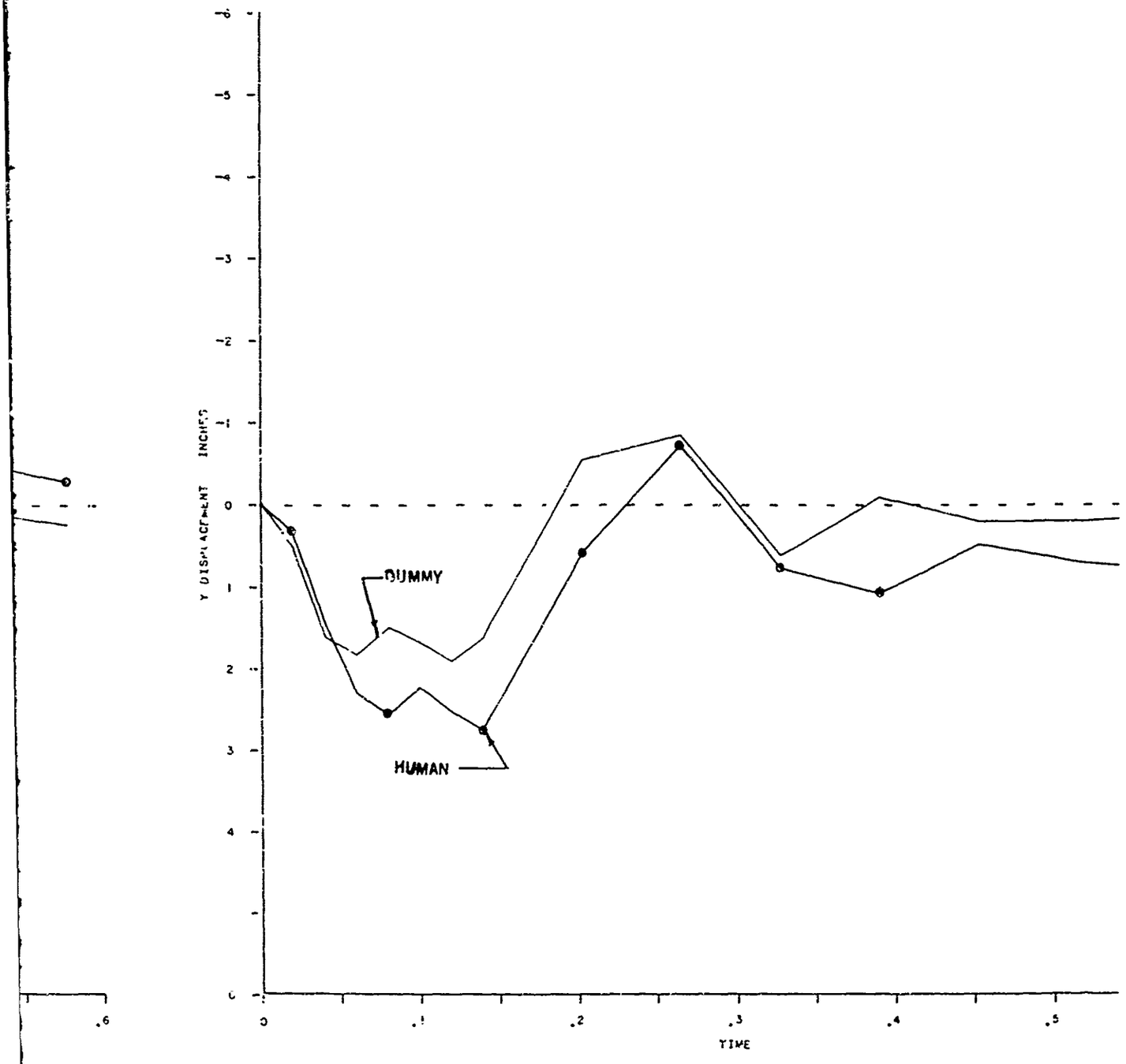
B

SUBJECTS - BRICE &
SHOULDER POINT -



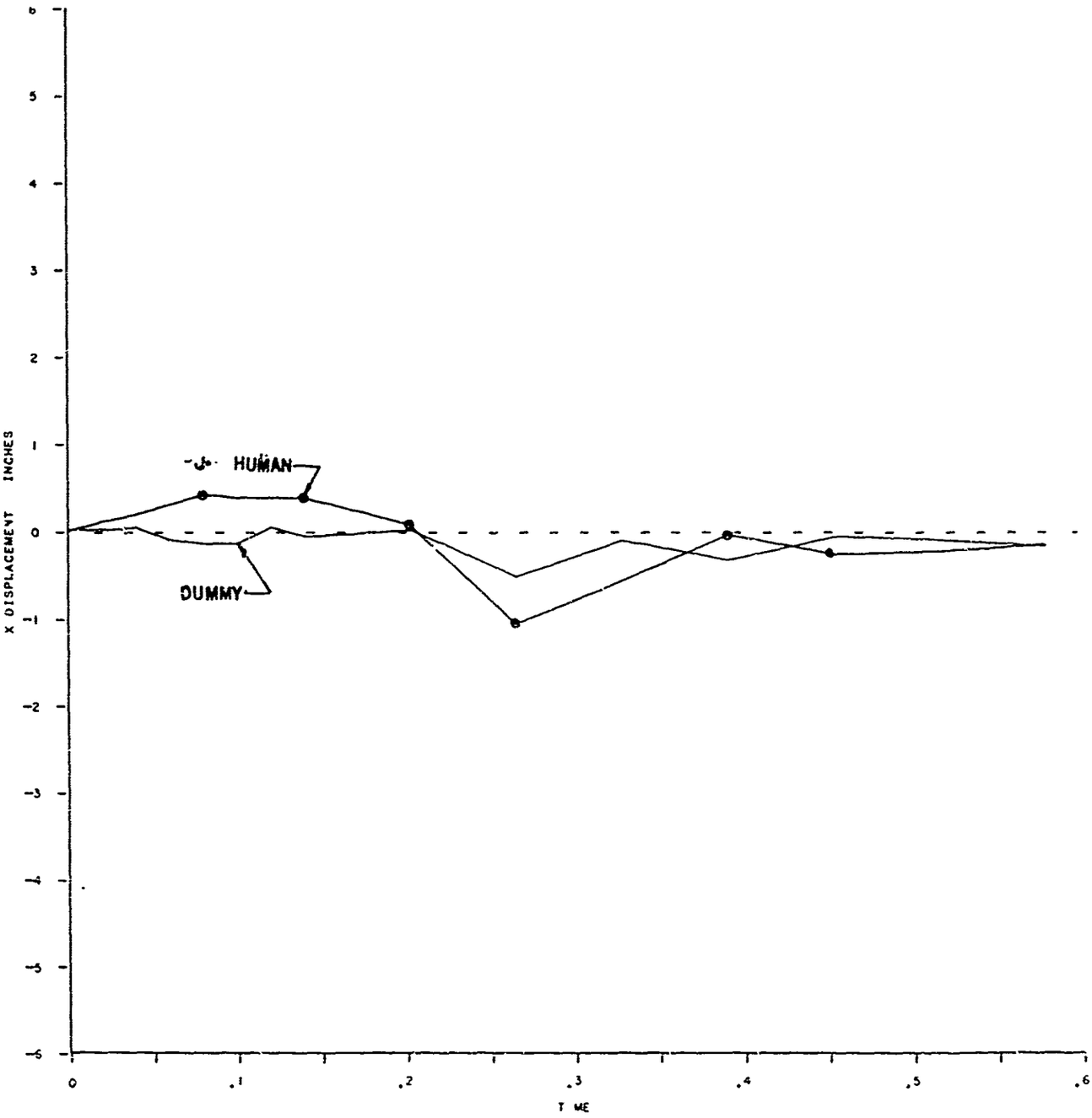
A

BRICE & 50%TILE DUMMY
POINT - TEST NO. 45 - 9 G



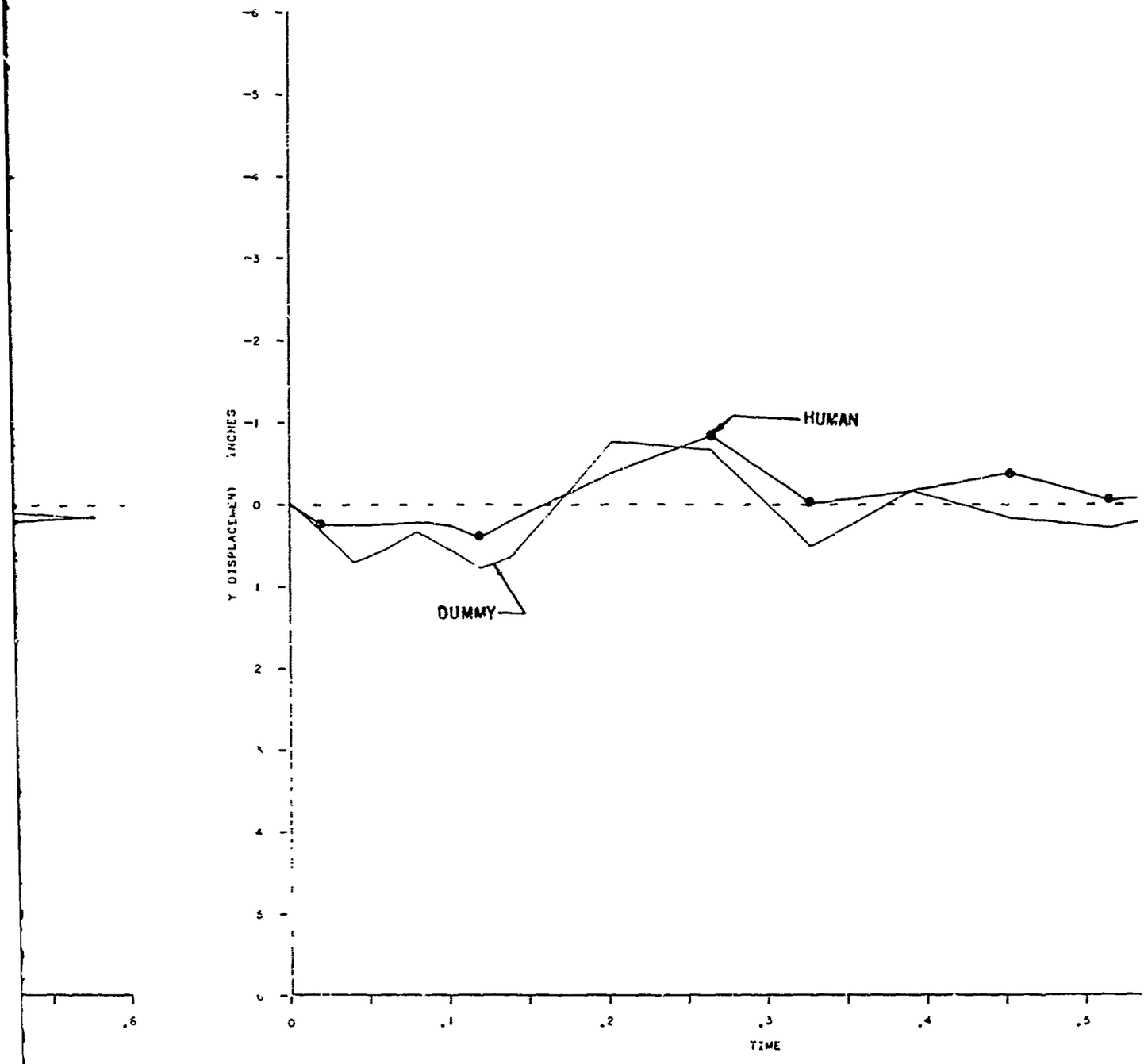
B

SUBJECTS - BRICE & 5
THIGH POINT - TEST



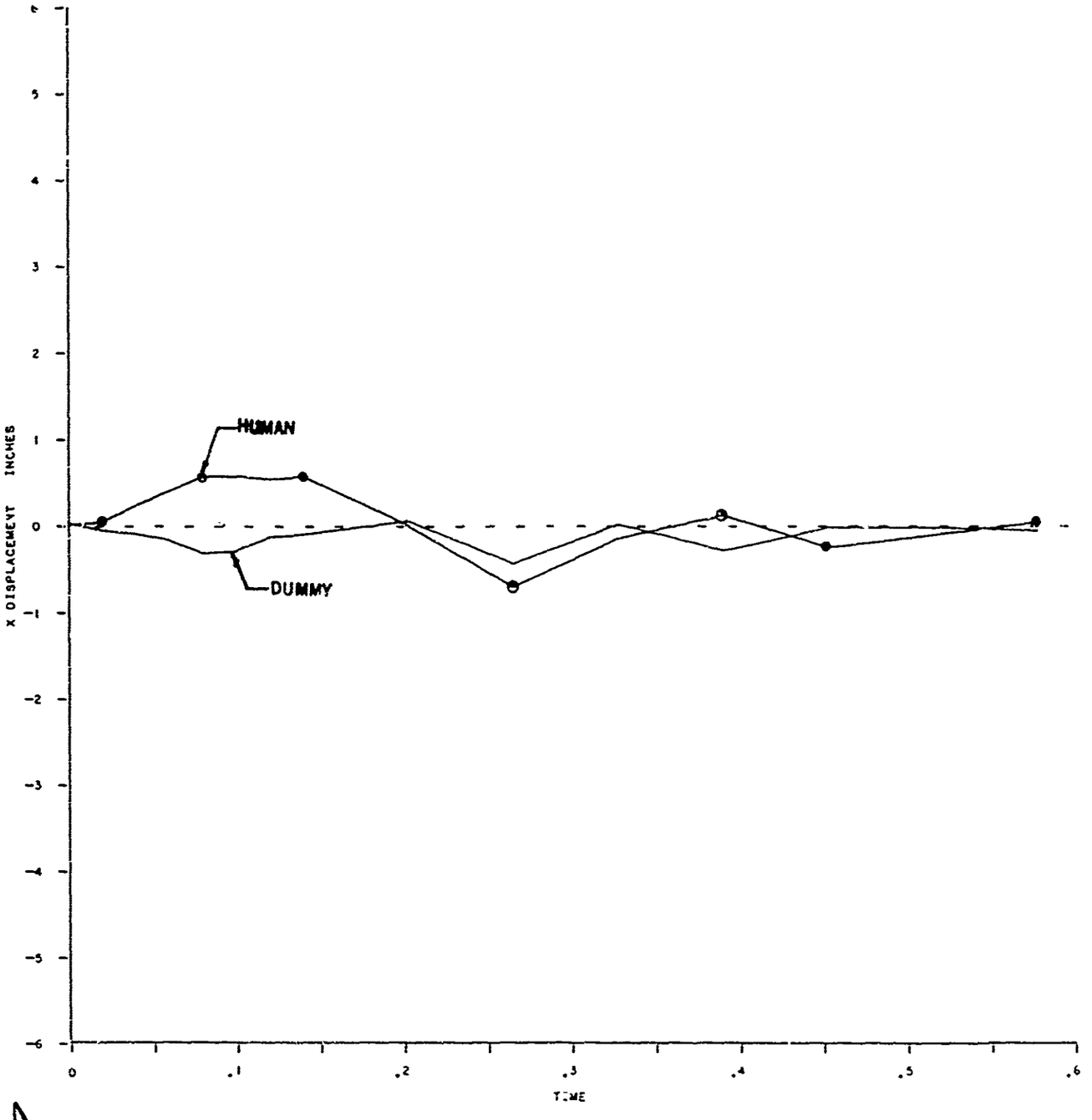
A

BRICE & 50%TILE DUMMY
NT - TEST NO. 45 - 9 G

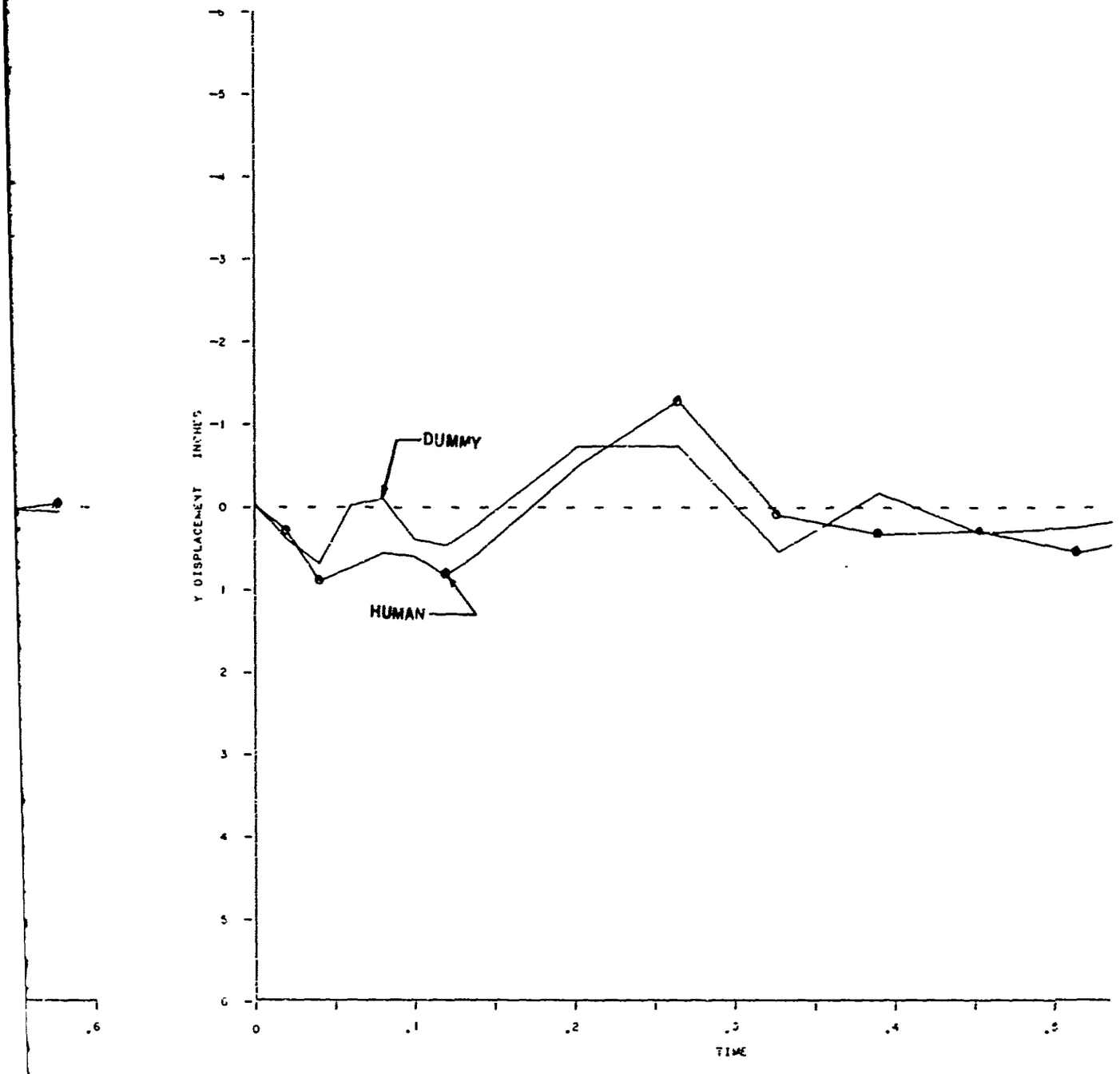


B

SUBJECTS - BRICE & 5
KNEE POINT - TEST

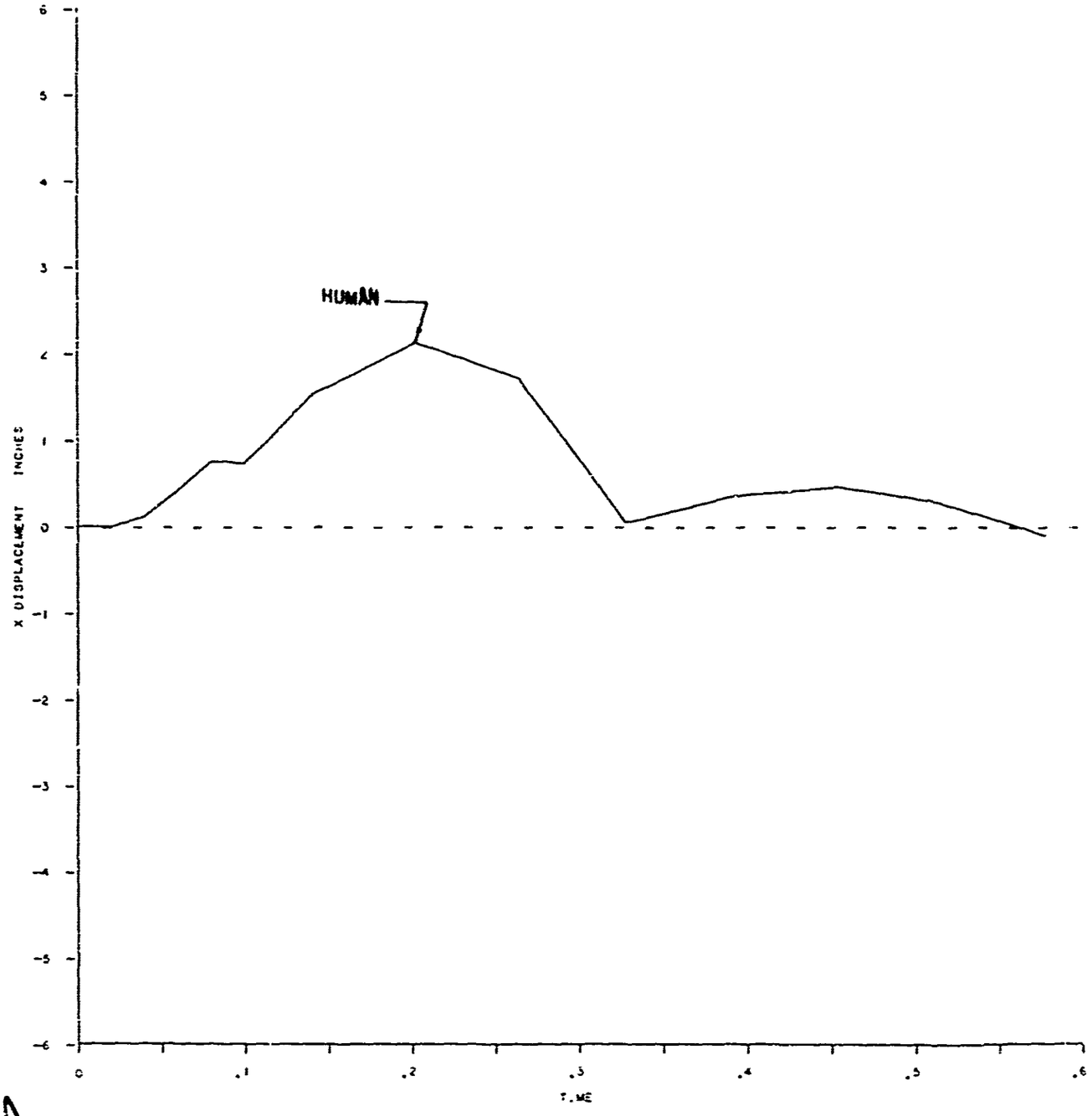


BRICE & 50%TILE DUMMY
NT - TEST NO. 45 - 9 G

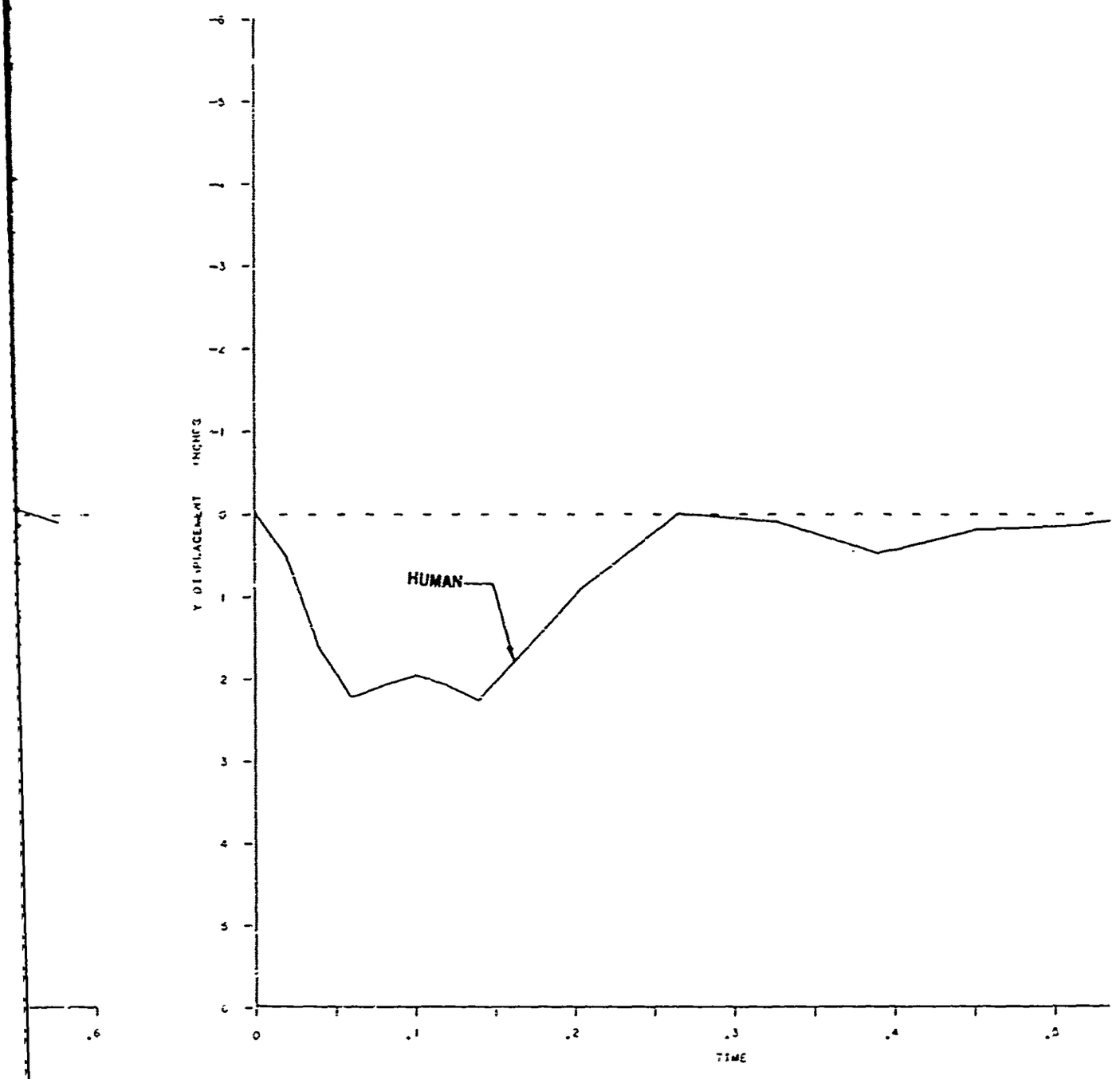


B

SUBJECTS - BRICE &
TEMPLE POINT - TI

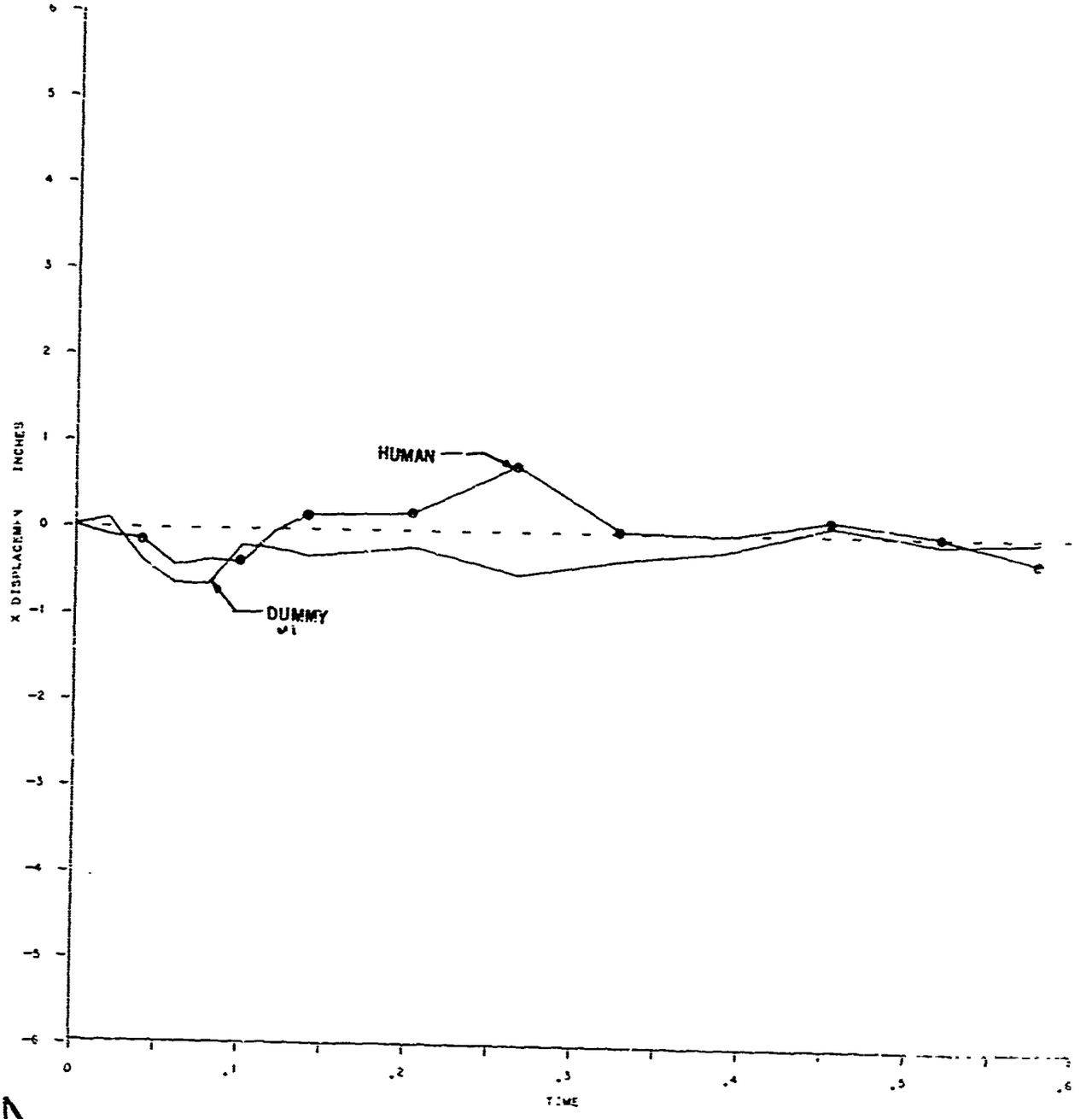


BRICE & 50%TILE DUMMY
INT - TEST NO.46 - 10 G

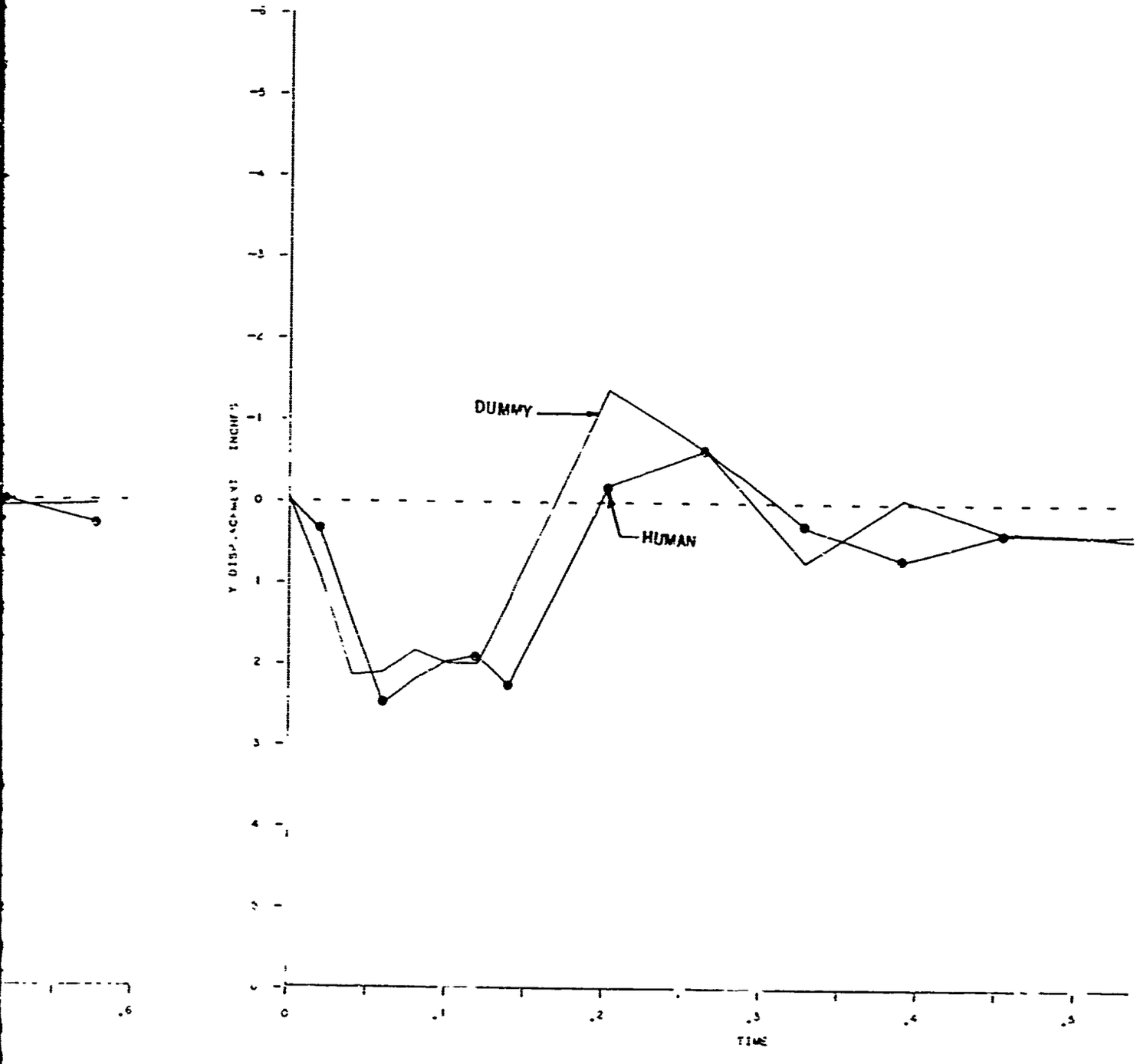


B

SUBJECTS - BRICE & 5(
SHOULDER POINT - TE

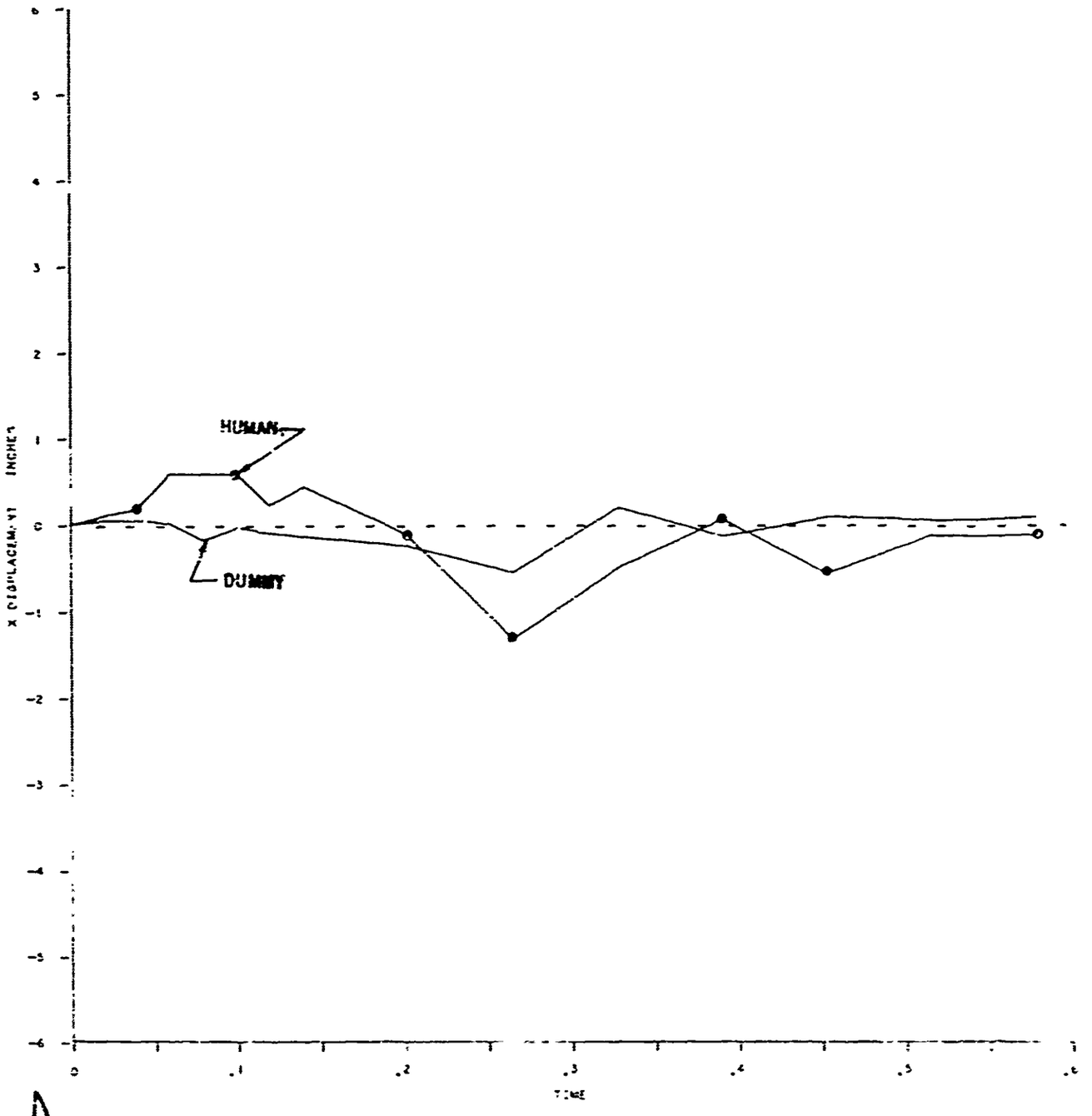


BRICE & 50%TILE DUMMY
POINT - TEST NO. 46 - 10 G

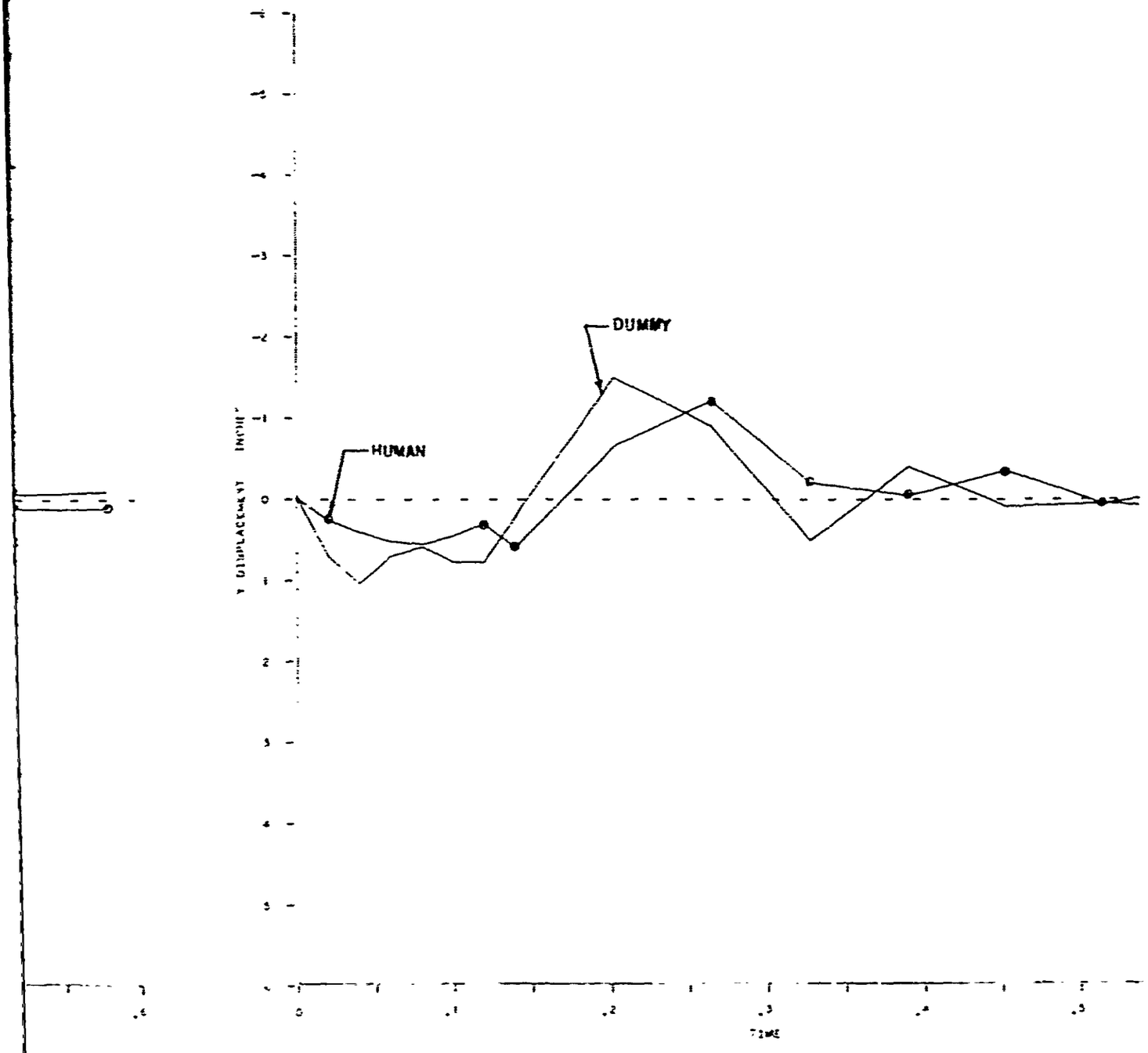


B

SUBJECTS - BRICE & 5(
THIGH POINT - TEST

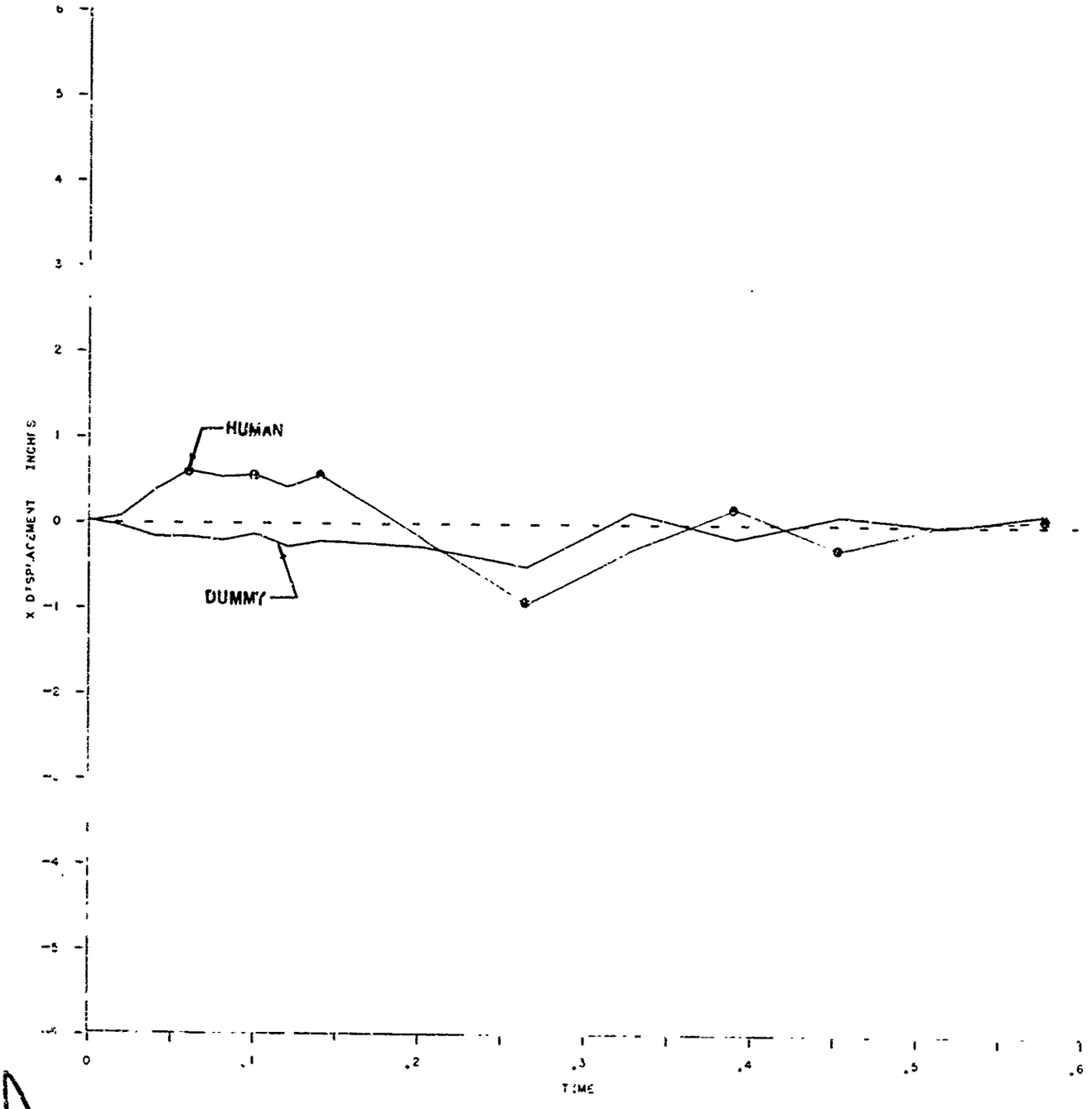


BRICE & 50%TILE DUMMY
DINT - TEST NO. 46 - 10 G



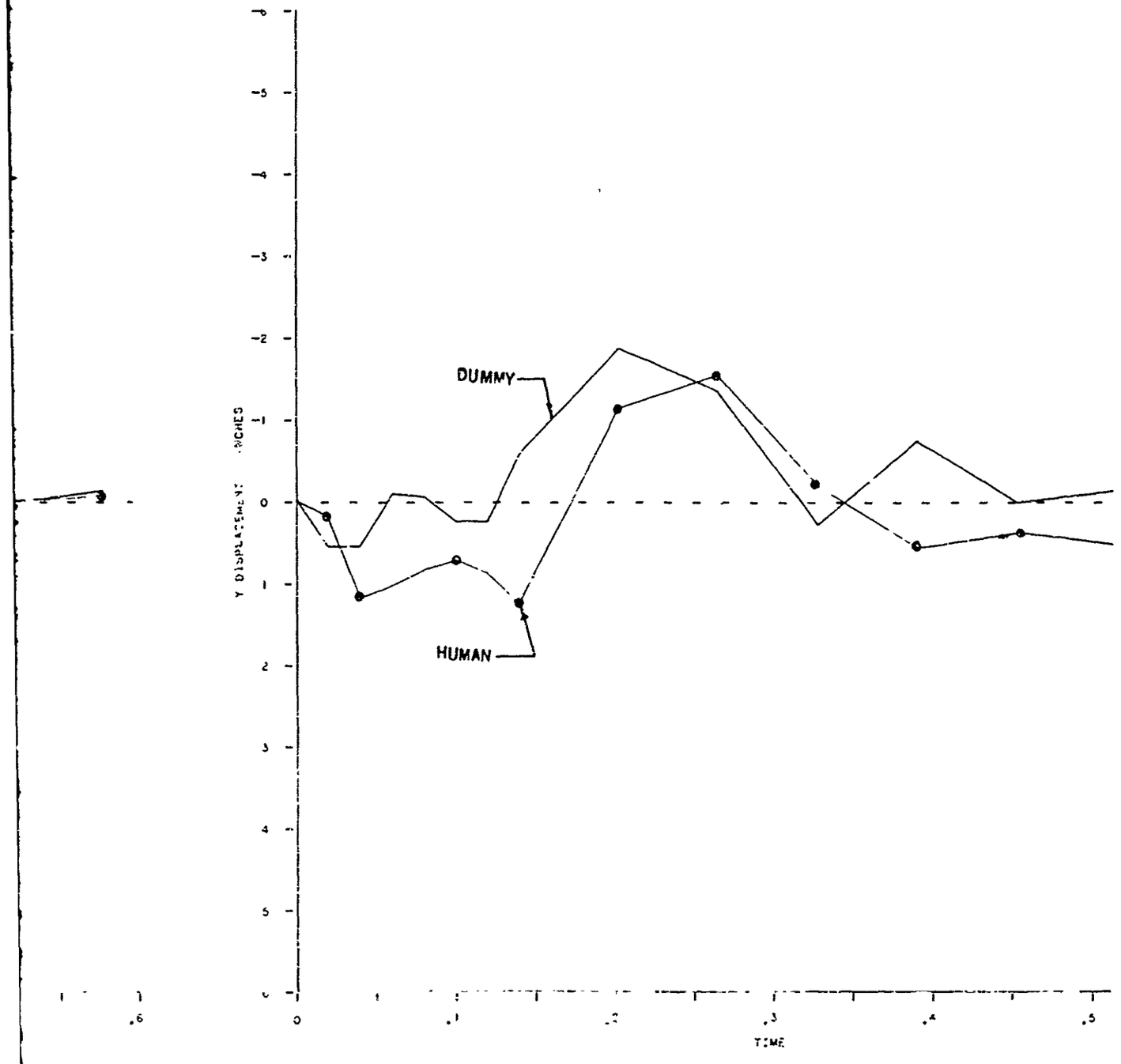
B

SUBJECTS - BRICE &
KNEE POINT - TE



A

- BRICE & 50%TILE DUMMY
POINT - TEST NO. 46 - 10 G



B

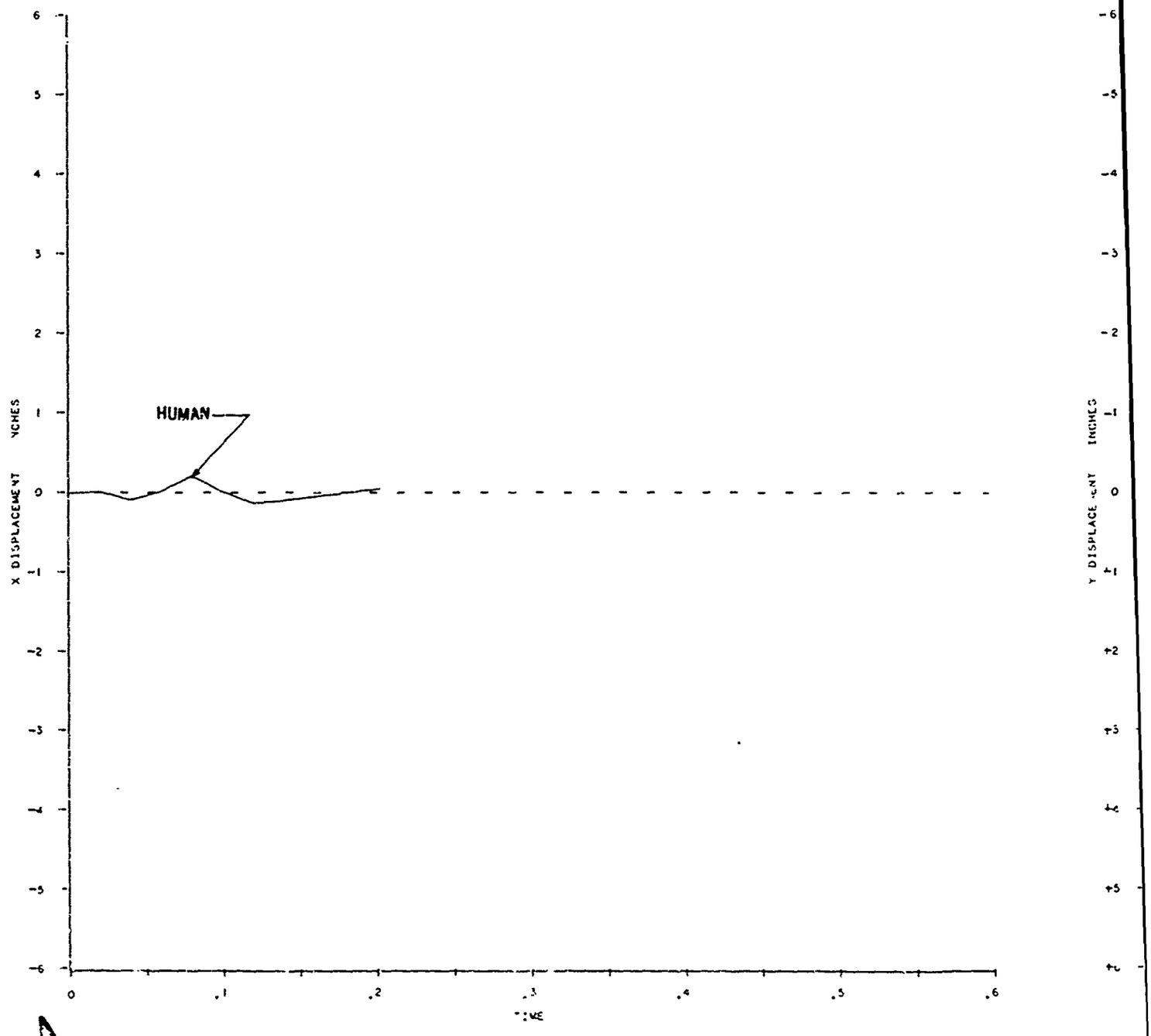
FIGURES 44 THRU 70

DATA PLOTS OF L. REED AND 5 PERCENTILE DUMMY

TEST NO.	G LEVEL	IMPACT VELOCITY
41	4.9	44 FPS
42	7.1	44 FPS
43	9.0	33 FPS
44	10.0	33 FPS

SUBJECTS - REED & 5%TILE

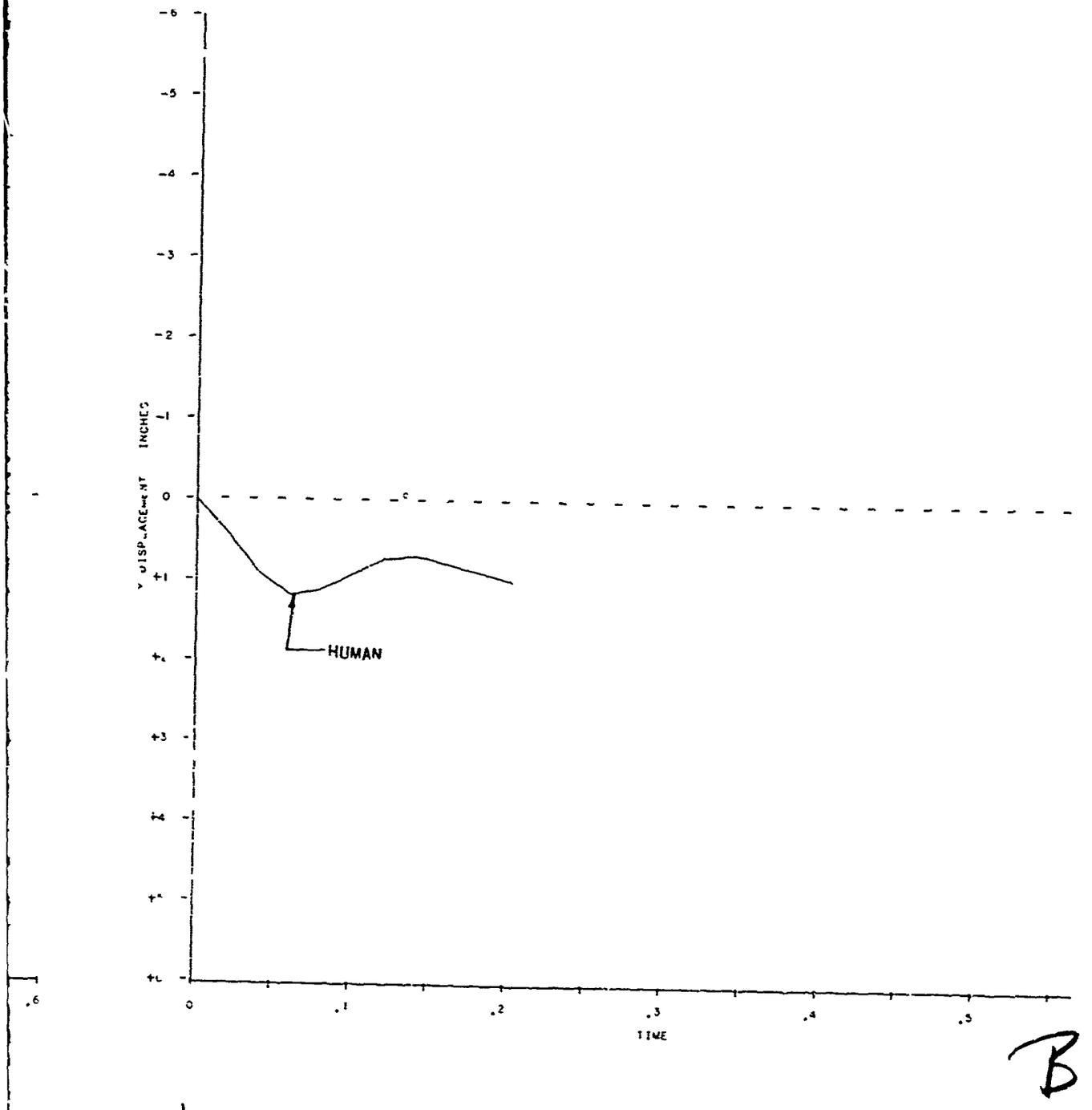
EYE POINT - TEST NO. 41



A

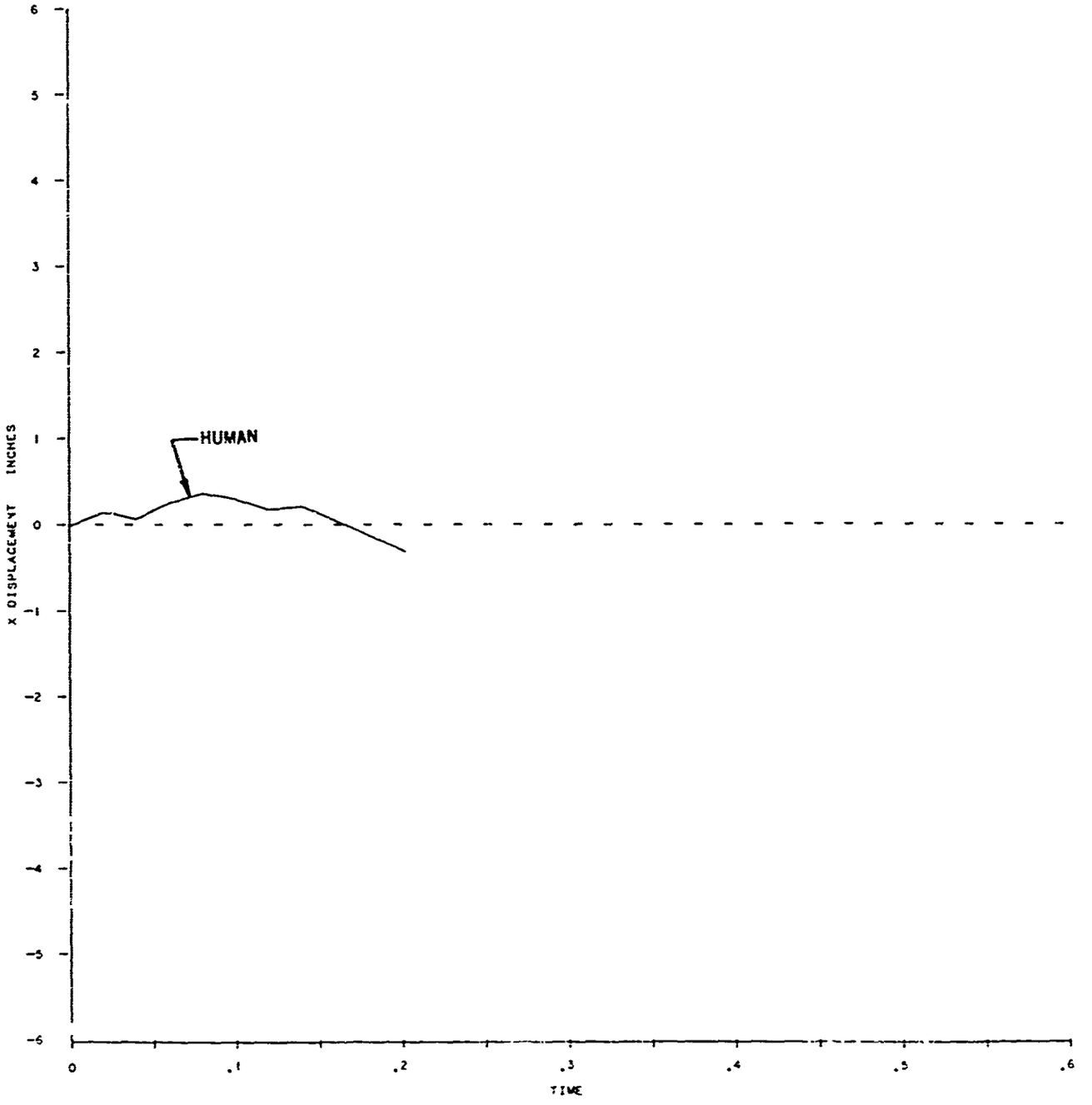
5%TILE DUMMY

NO. 41 4.9 G



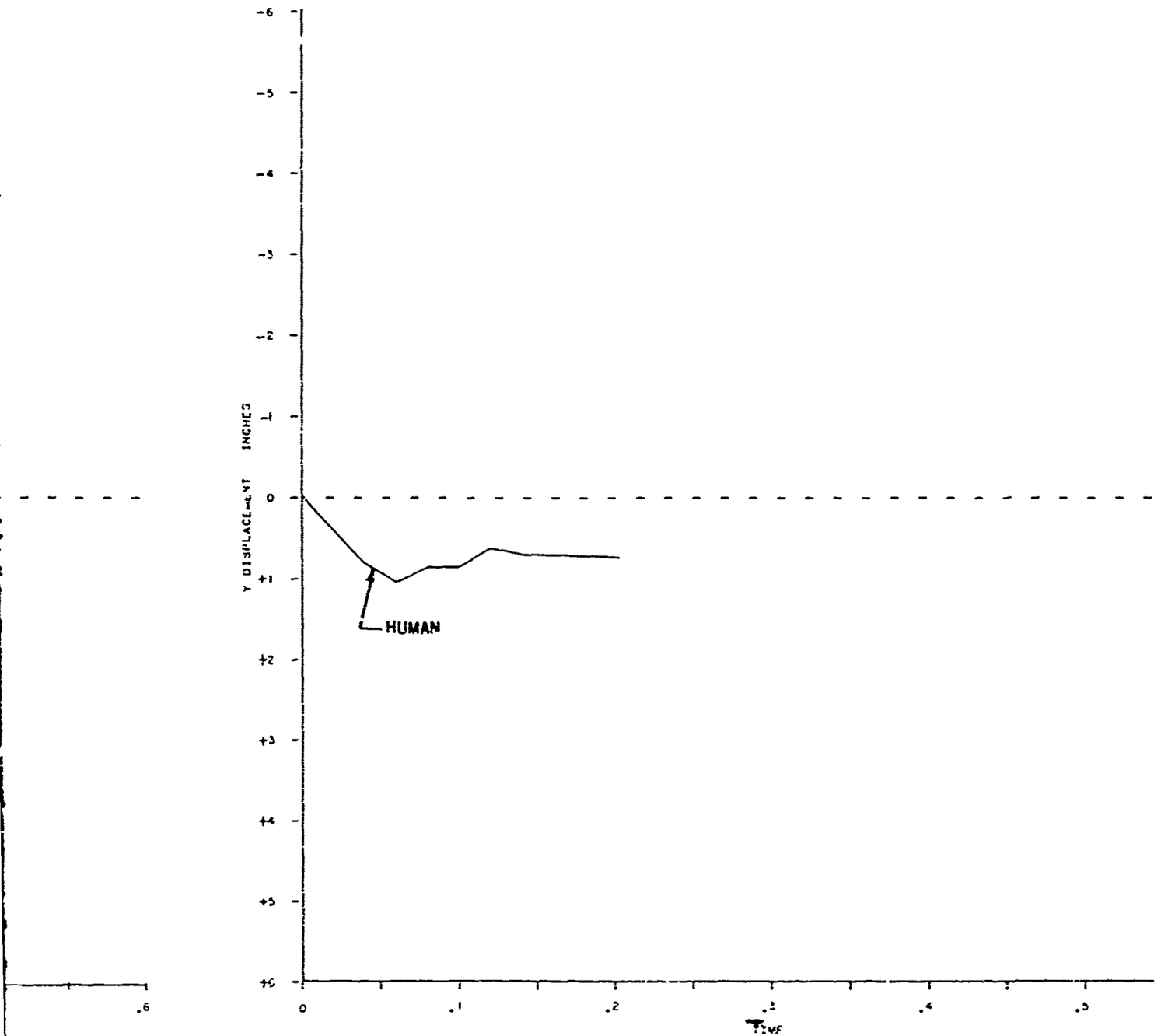
B

SUBJECT - REED & 5%TILE
NOSE POINT - TEST NO. 41 -



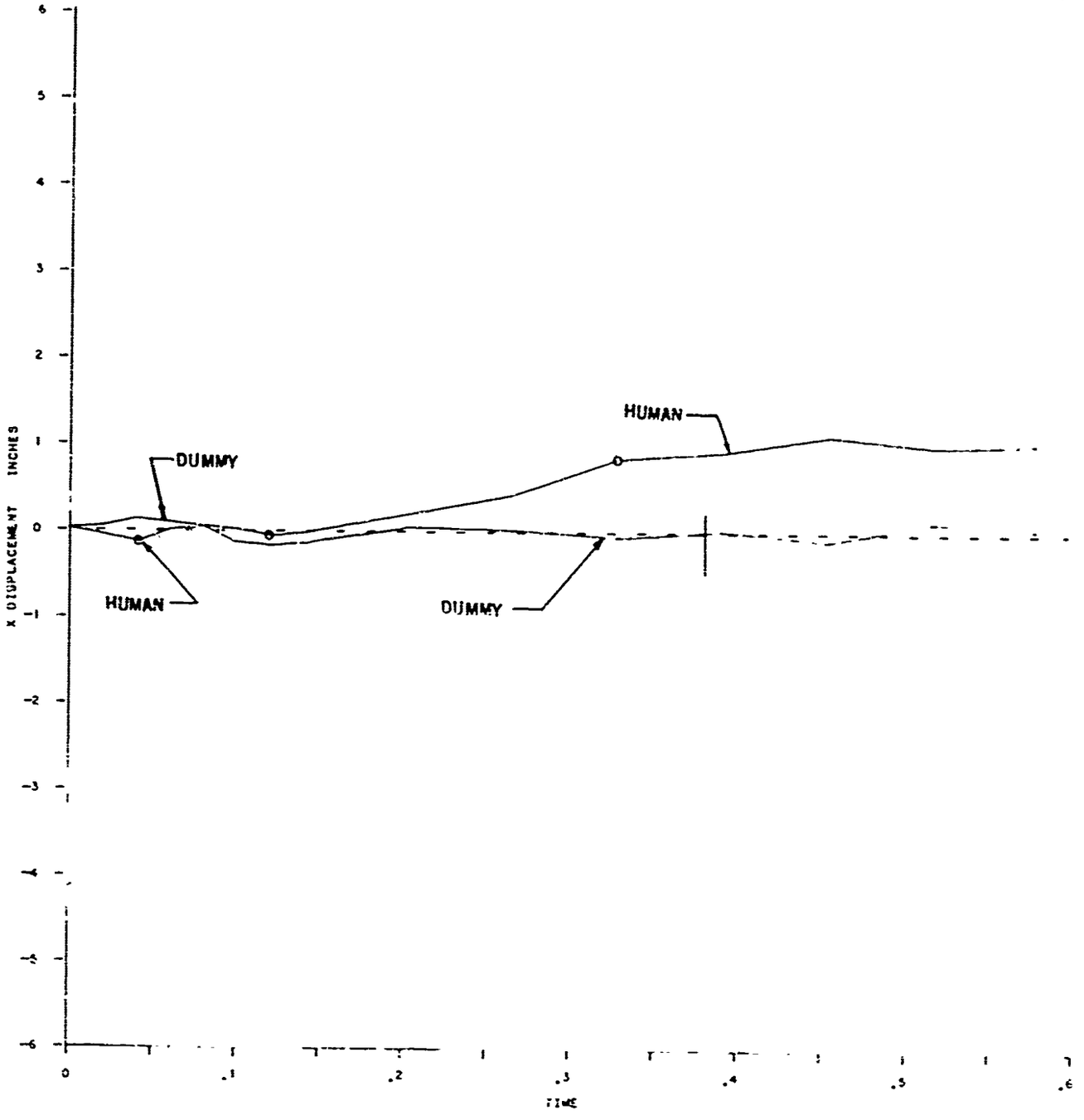
& 5%TILE DUMMY

D. 41 - 4.9 G



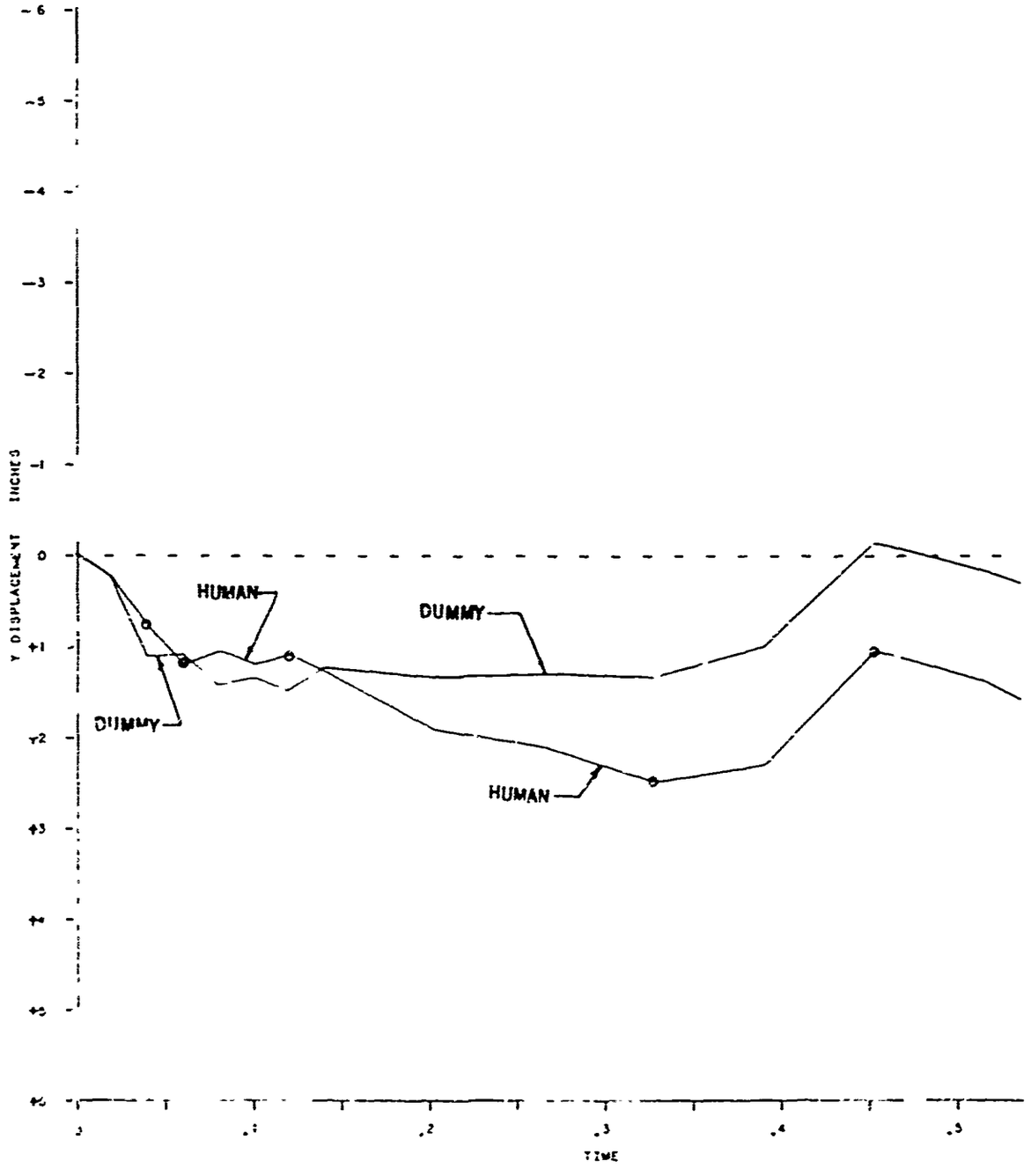
B

SUBJECTS - REED & 5%
SHOULDER POINT - TEST



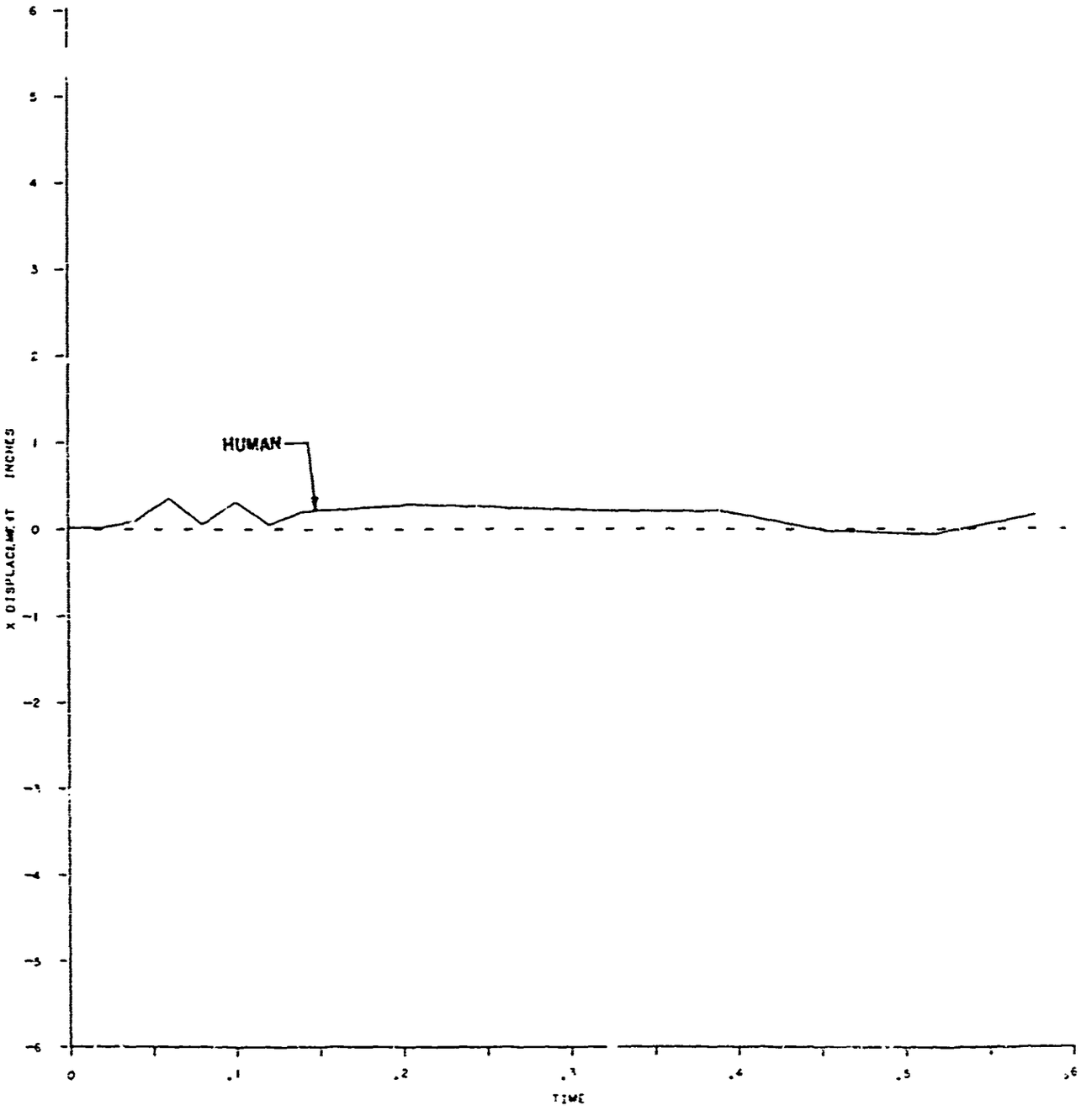
A

ED & 5%TILE DUMMY
T -TEST NO. 41 - 4.9 G



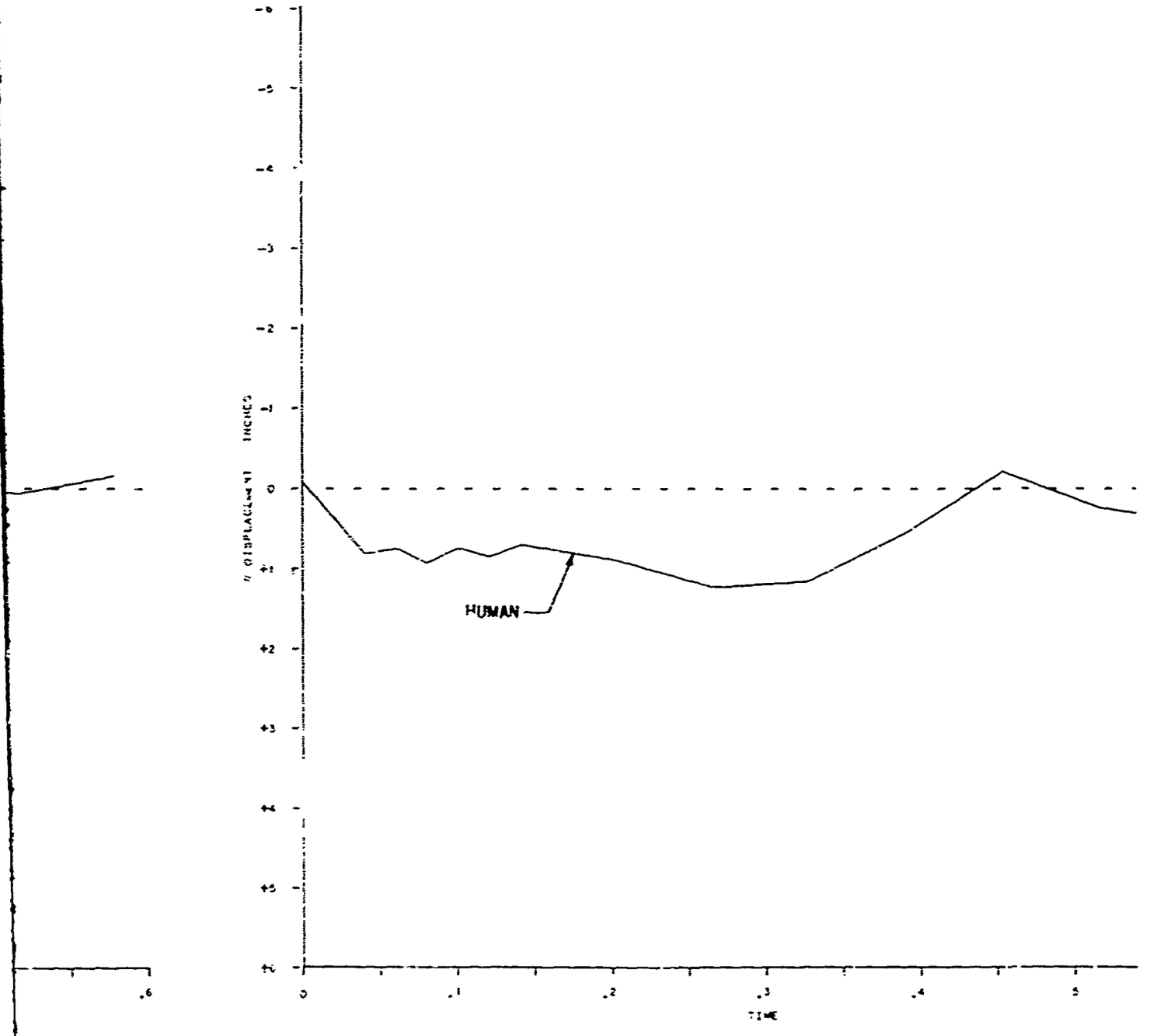
B

SUBJECTS - REED &
THIGH POINT - TEST



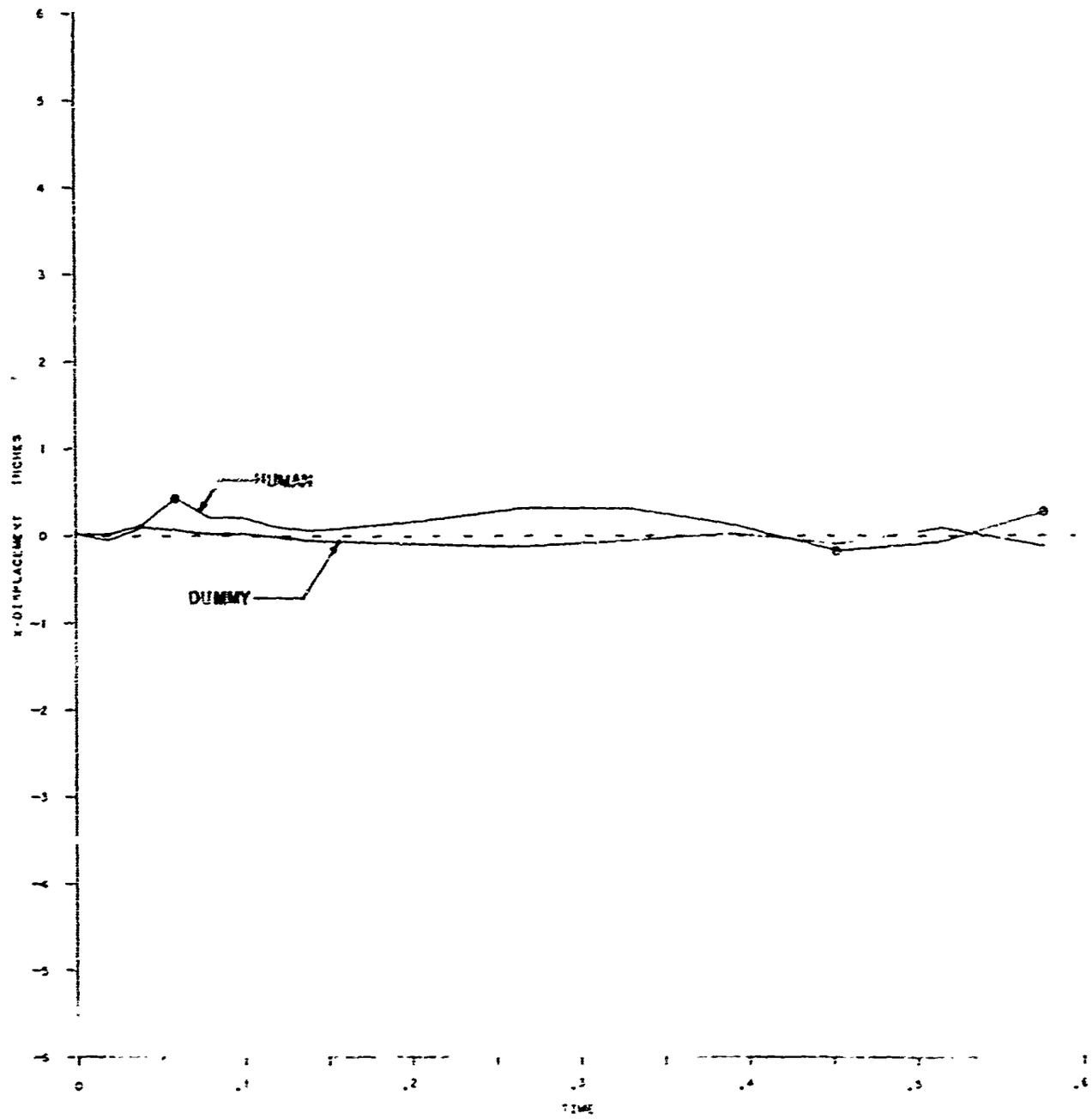
A

REED & 5%TILE DUMMY
T - TEST NO. 41 - 4.9 G

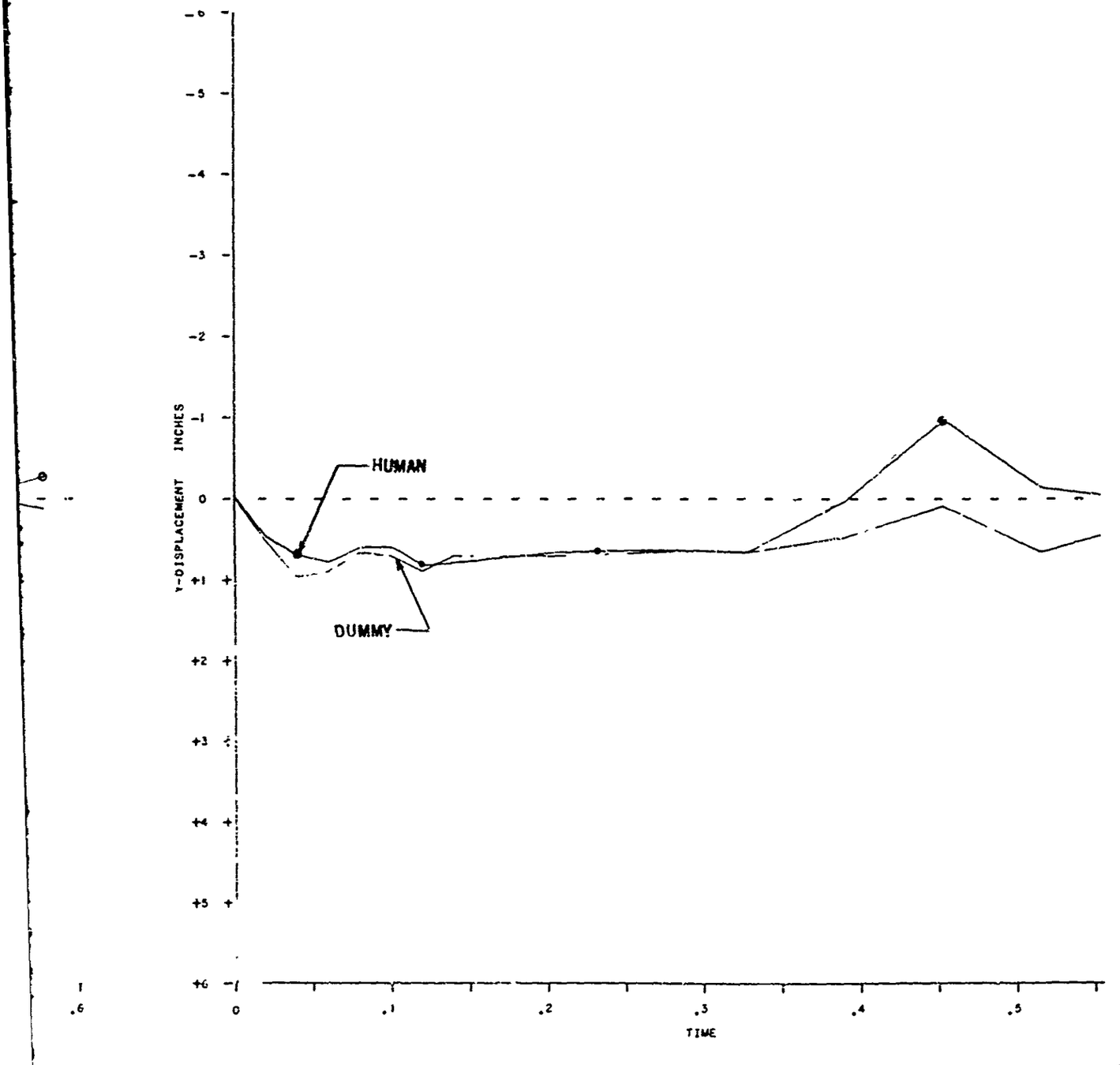


B

SUBJECTS - REED & 5%TI
KNEE POINT - TEST NO.

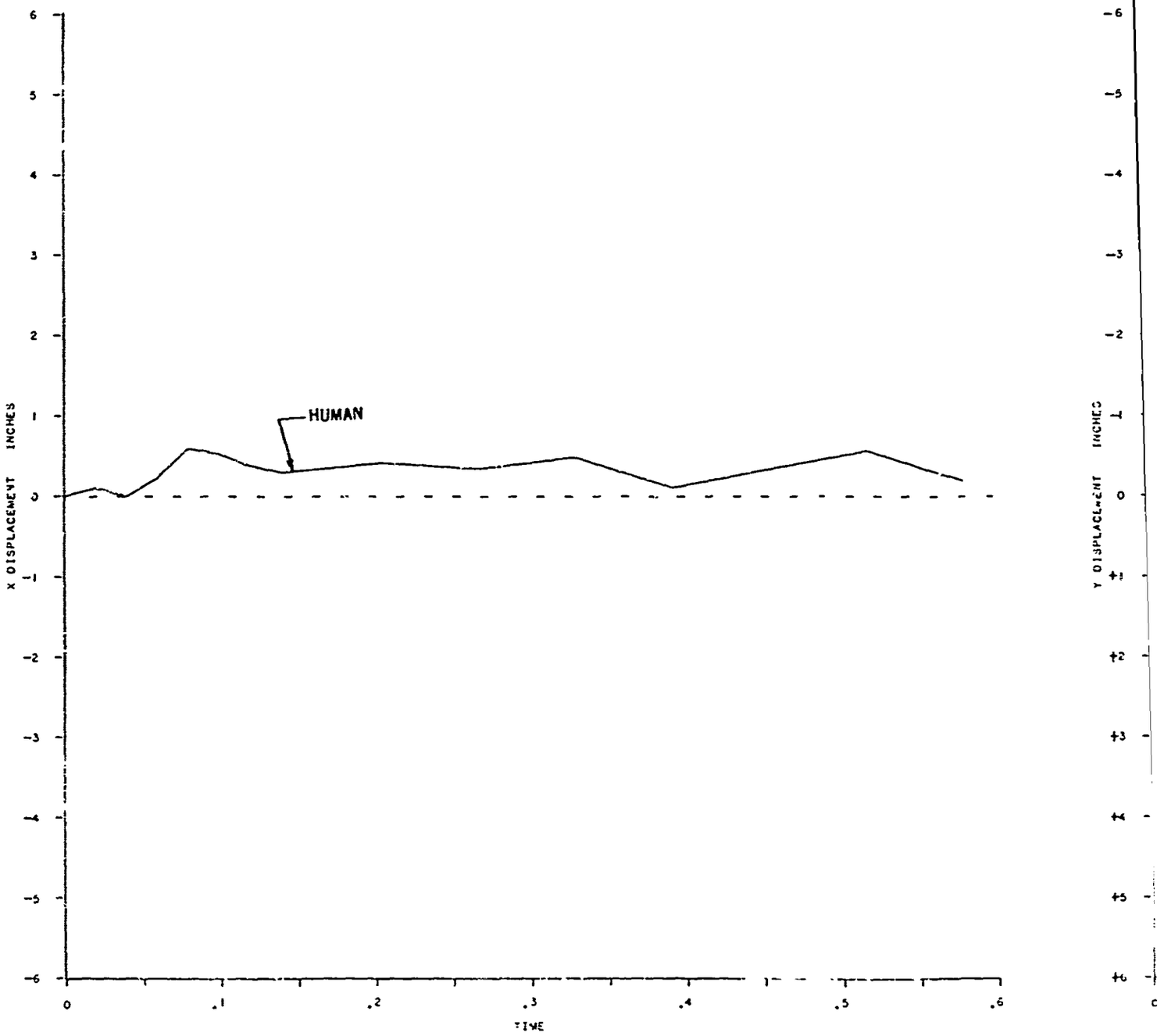


& 5%TILE DUMMY
ST NO. 41 - 4.9 G



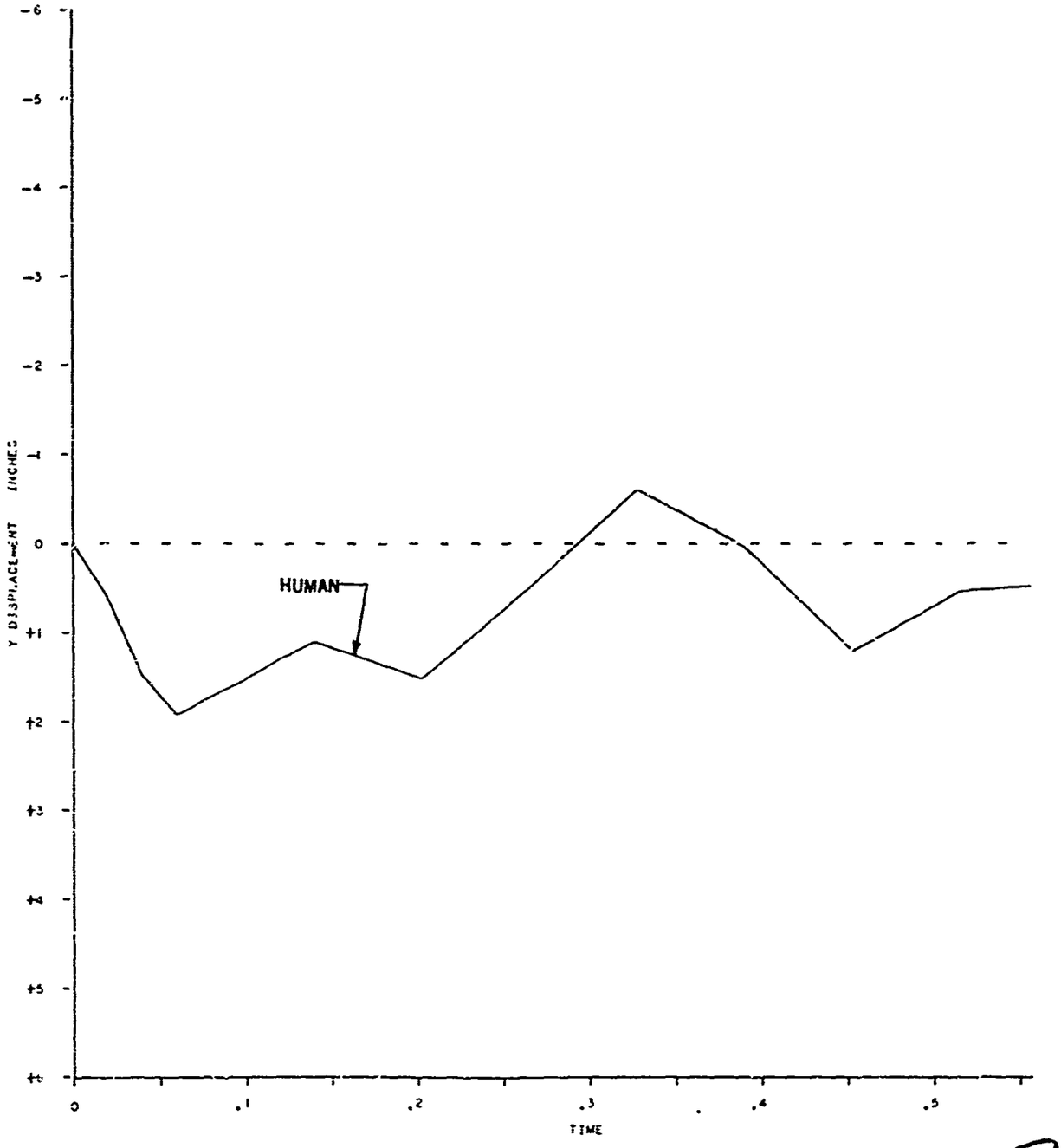
B

SUBJECTS - REED & 5%T
NOSE POINT - TEST NO.



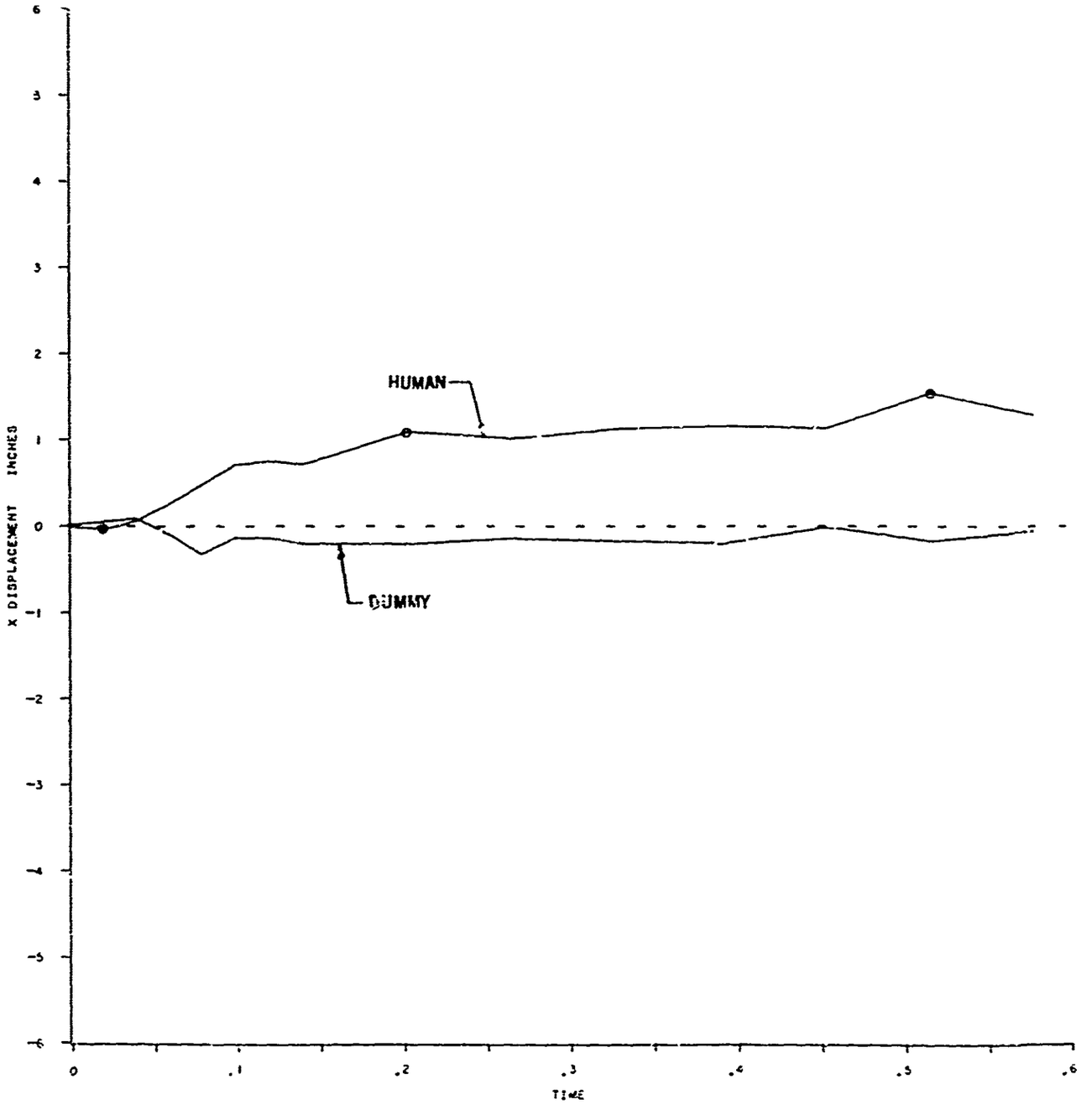
A

D & 5%TILE DUMMY
EST NO. 42 - 7.1 G



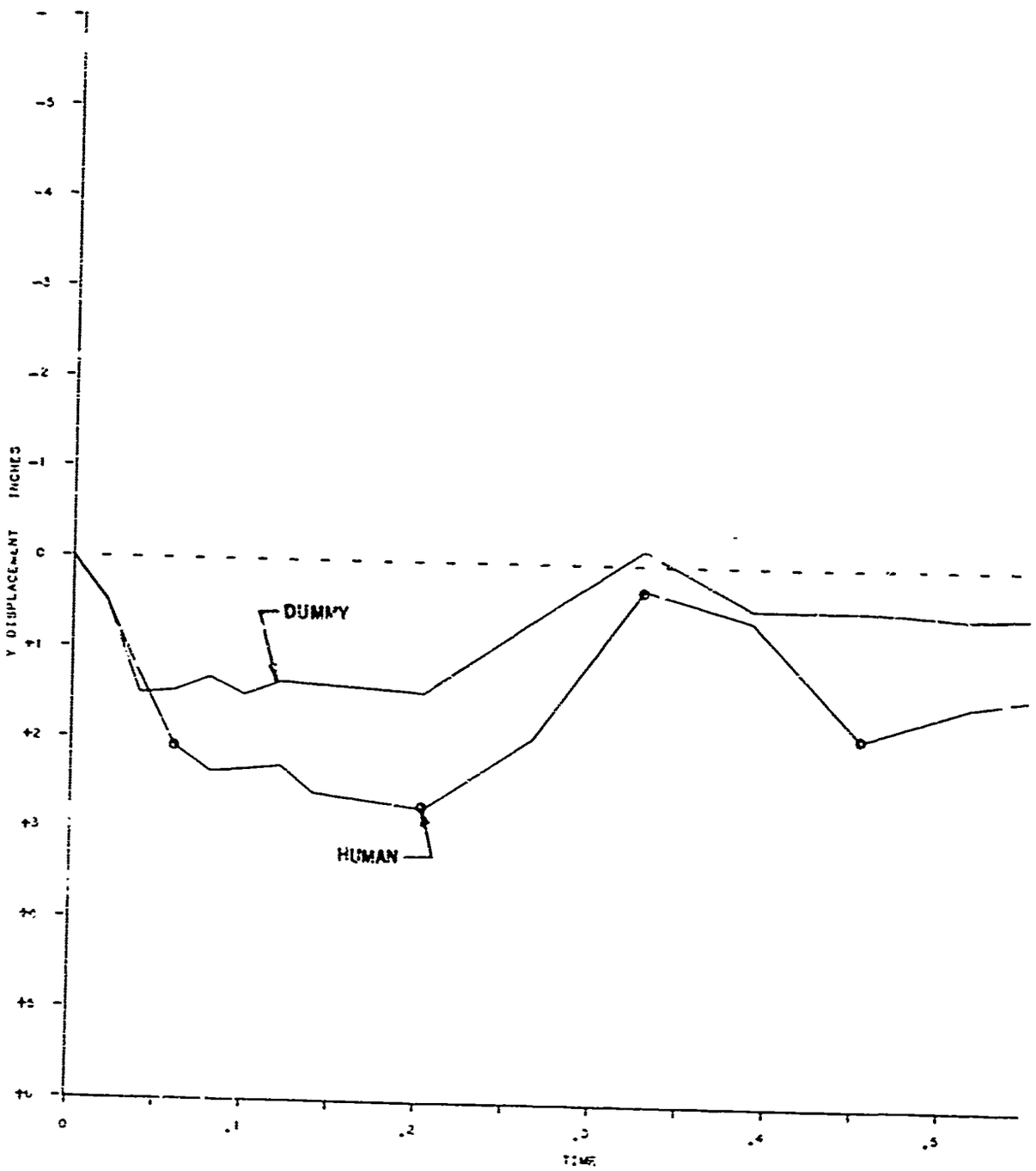
B

SUBJECTS - REED & 5
SHOULDER POINT - TEST



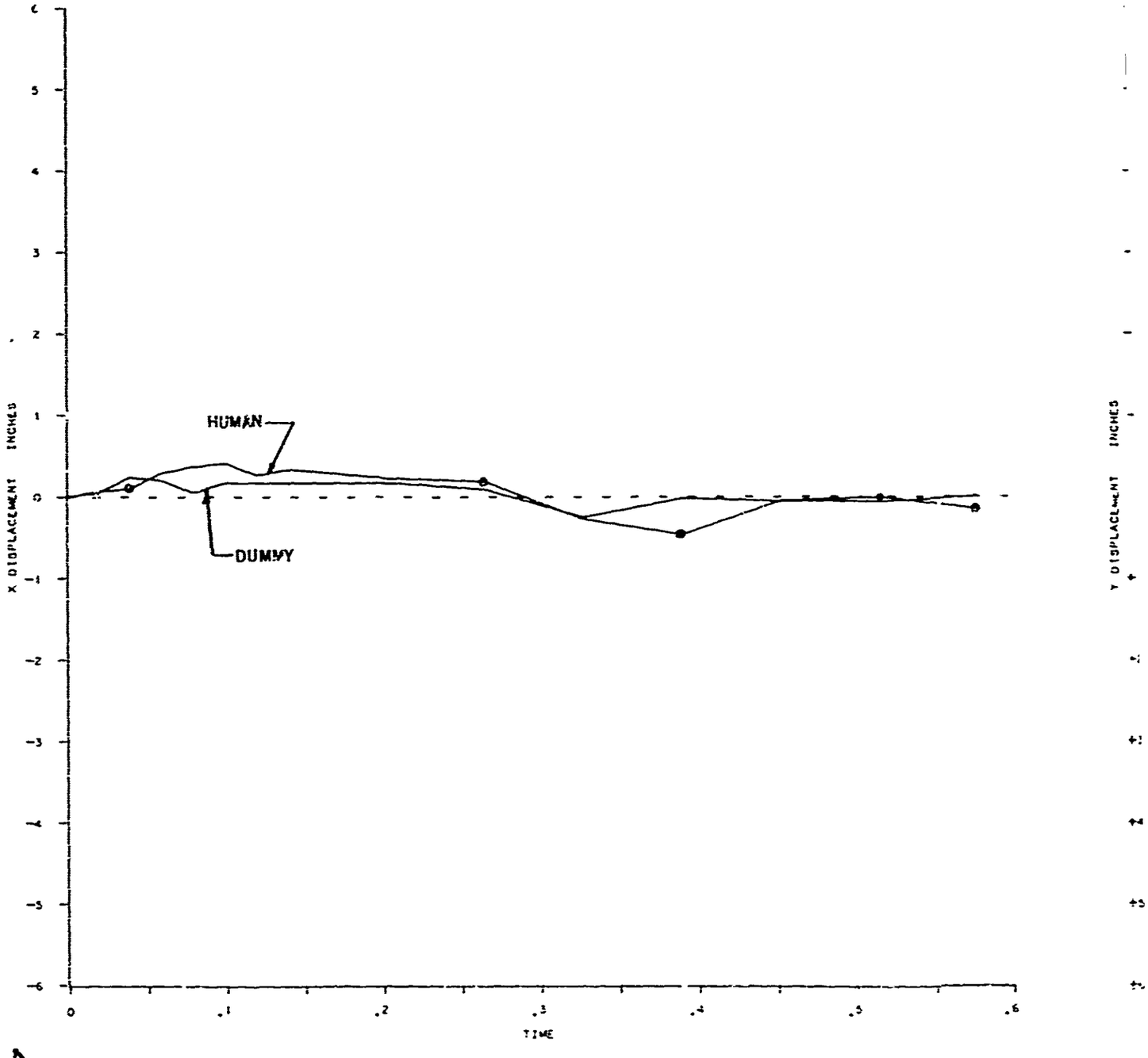
A

- REED & 5%TILE DUMMY
OINT - TEST NO. 42 - 7.1 G



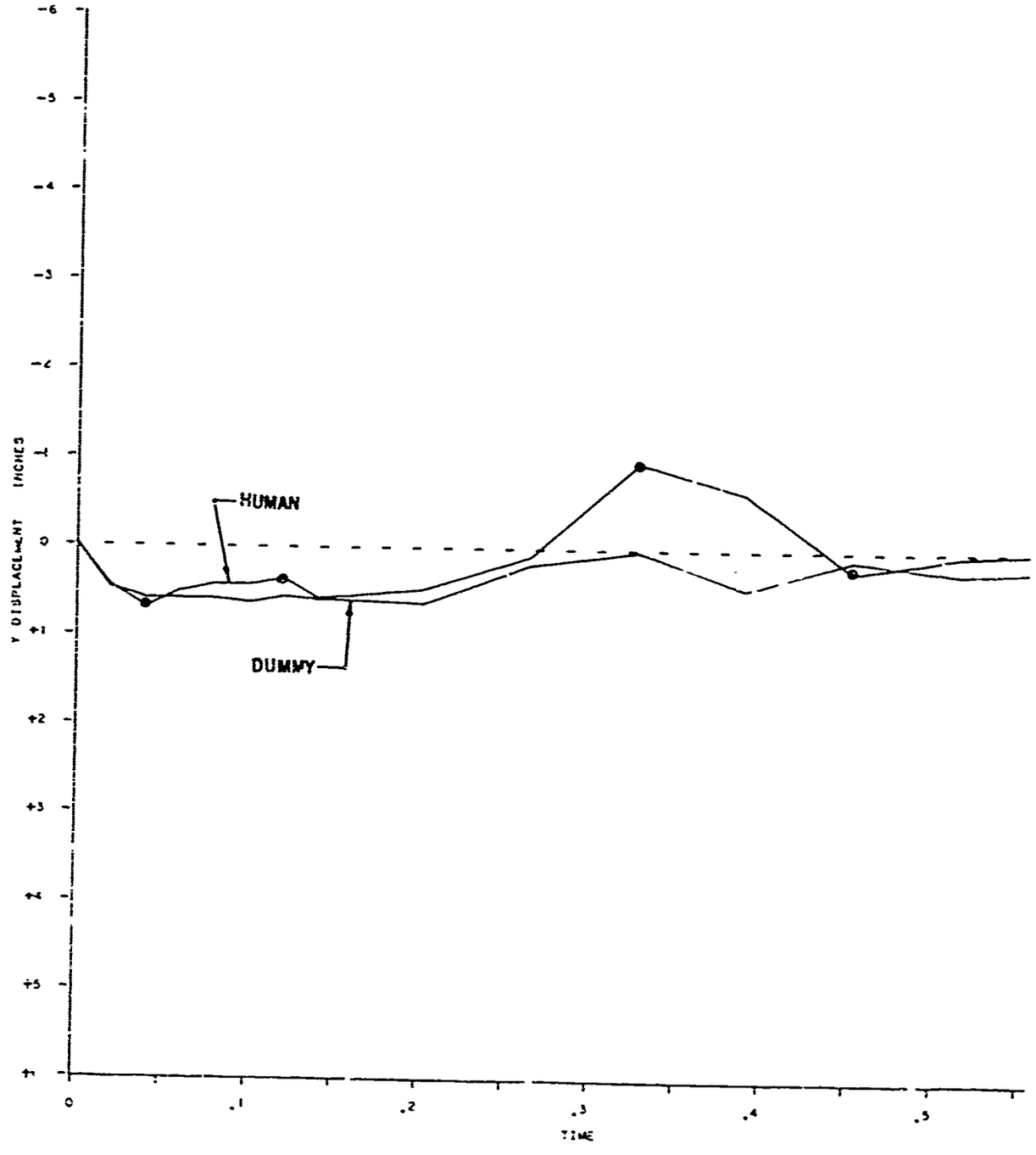
B

SUBJECTS - REED & 5%
THIGH POINT - TEST NO.



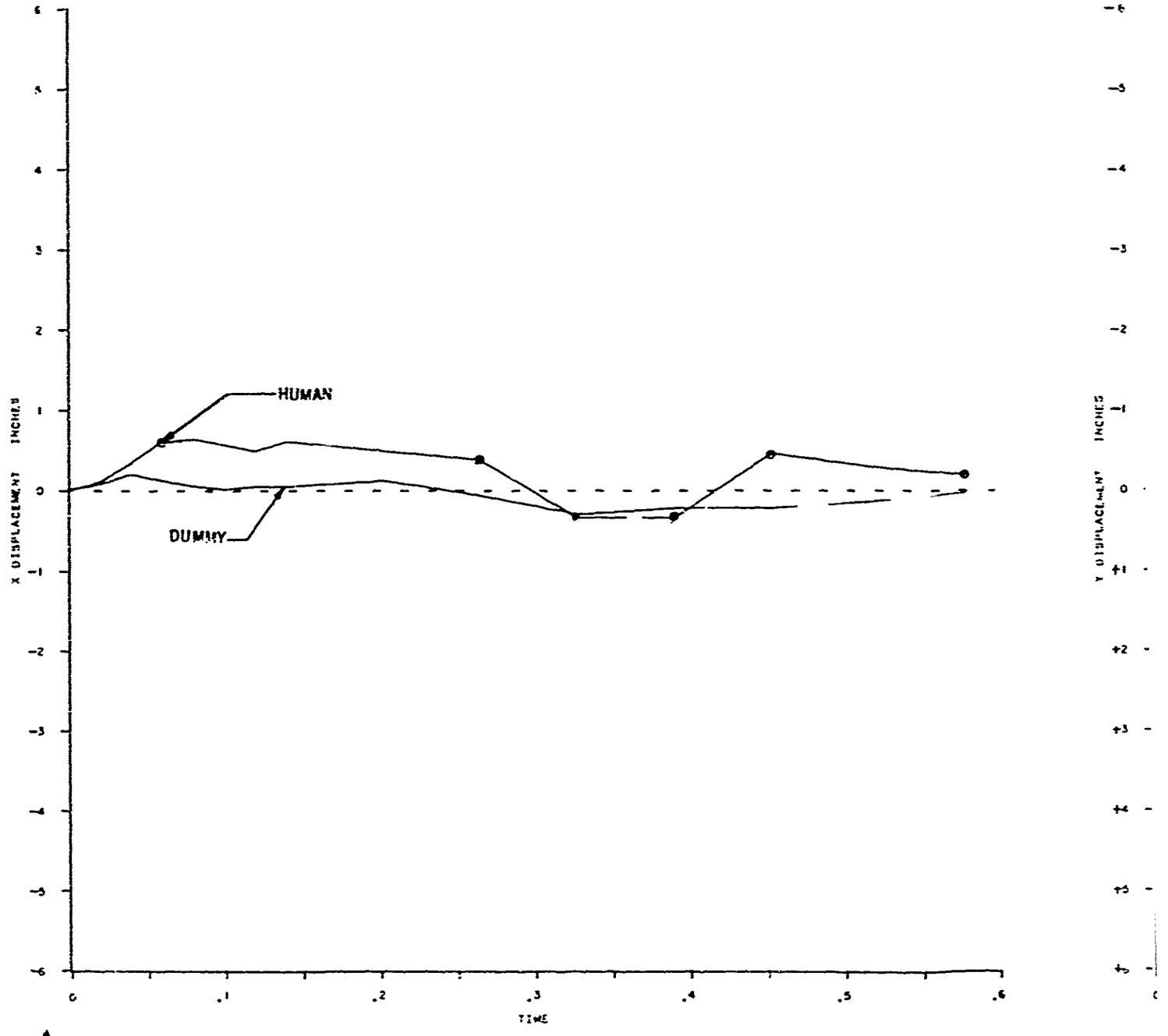
A

ED & 5%TILEDUMMY
TEST NO. 42 - 7.1 G

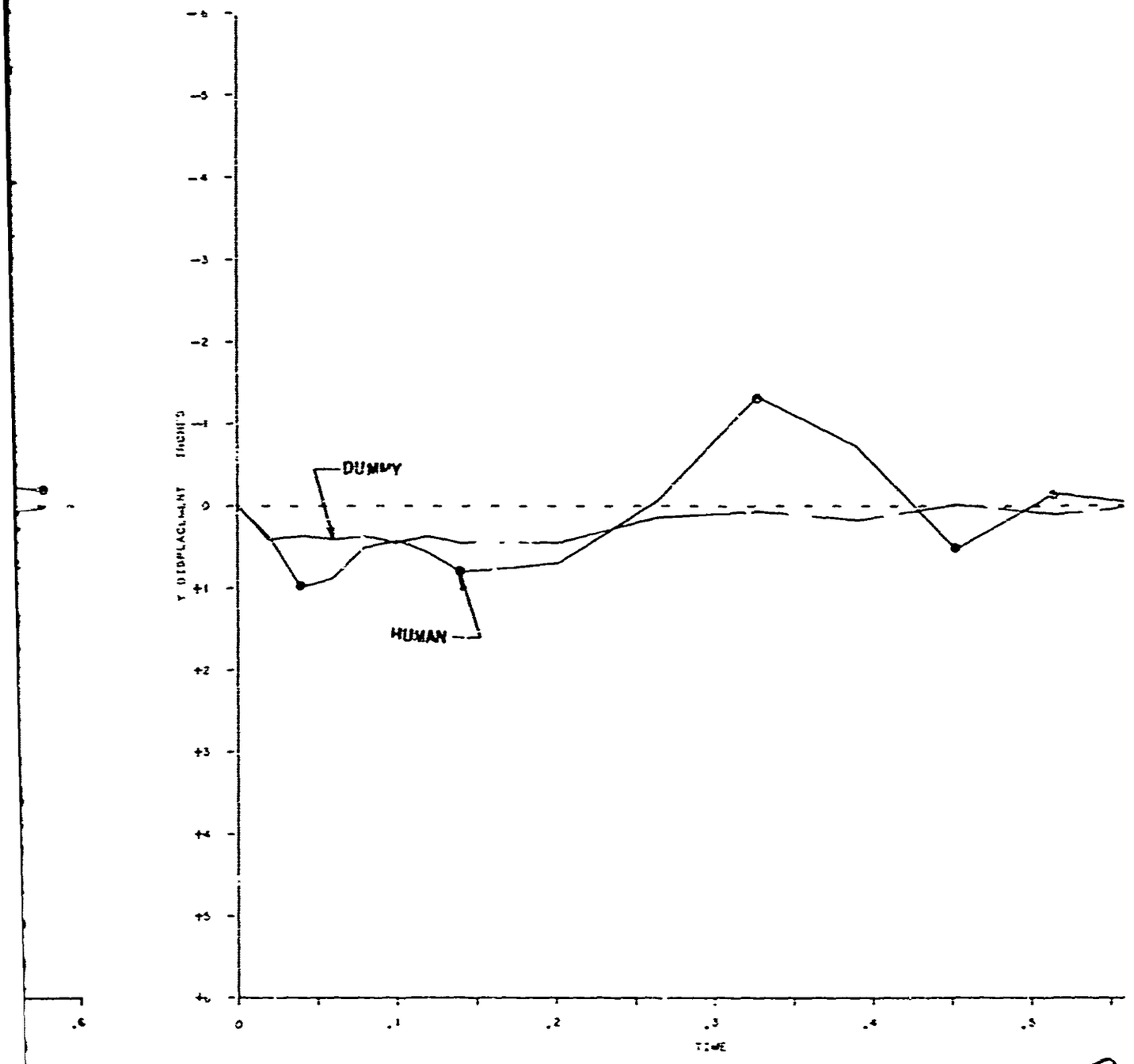


B

SUBJECTS - REED & 5
KNEE POINT - TEST

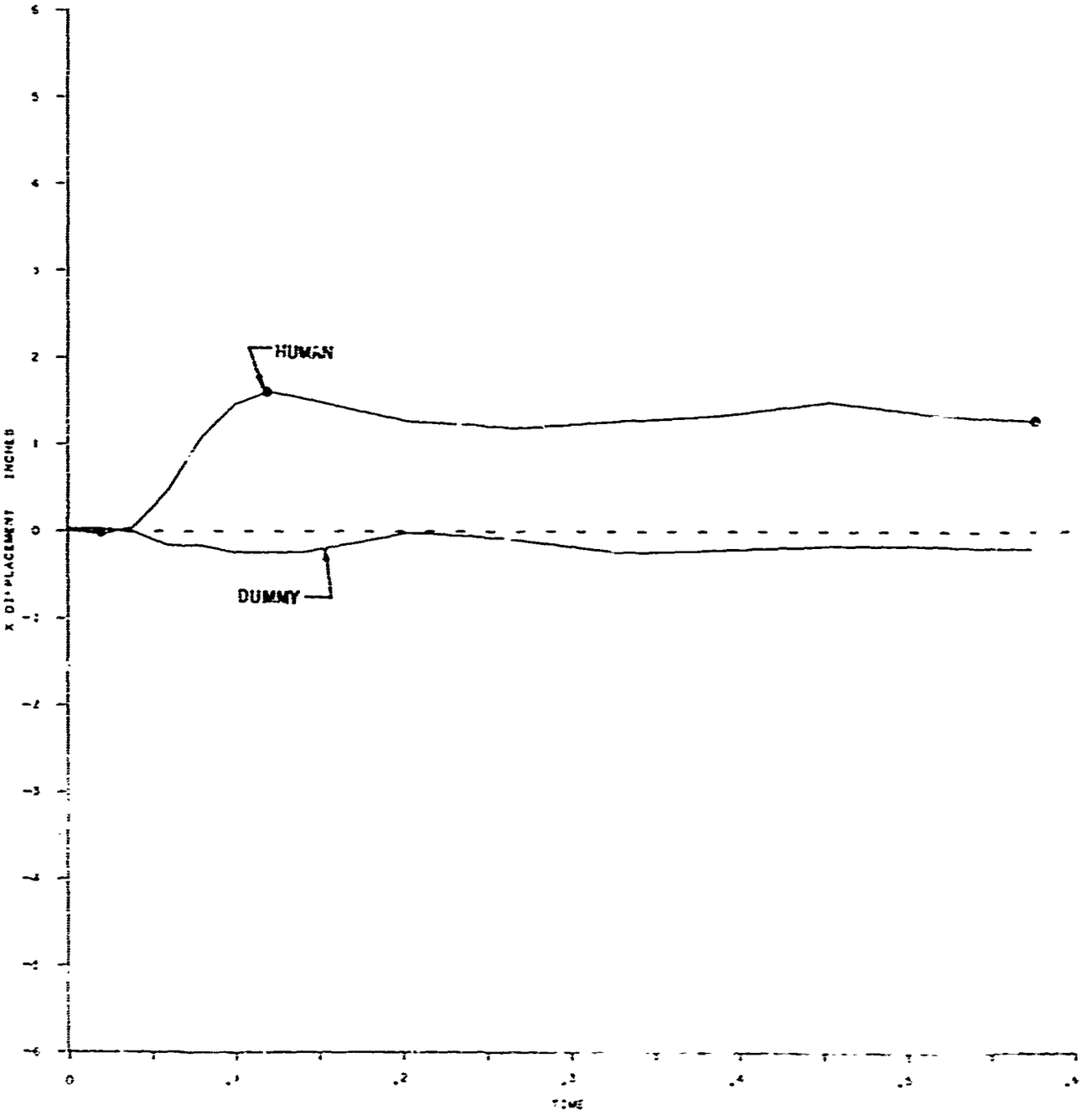


REED & 5%TILE DUMMY
- TEST NO. 42 - 7.1 -G

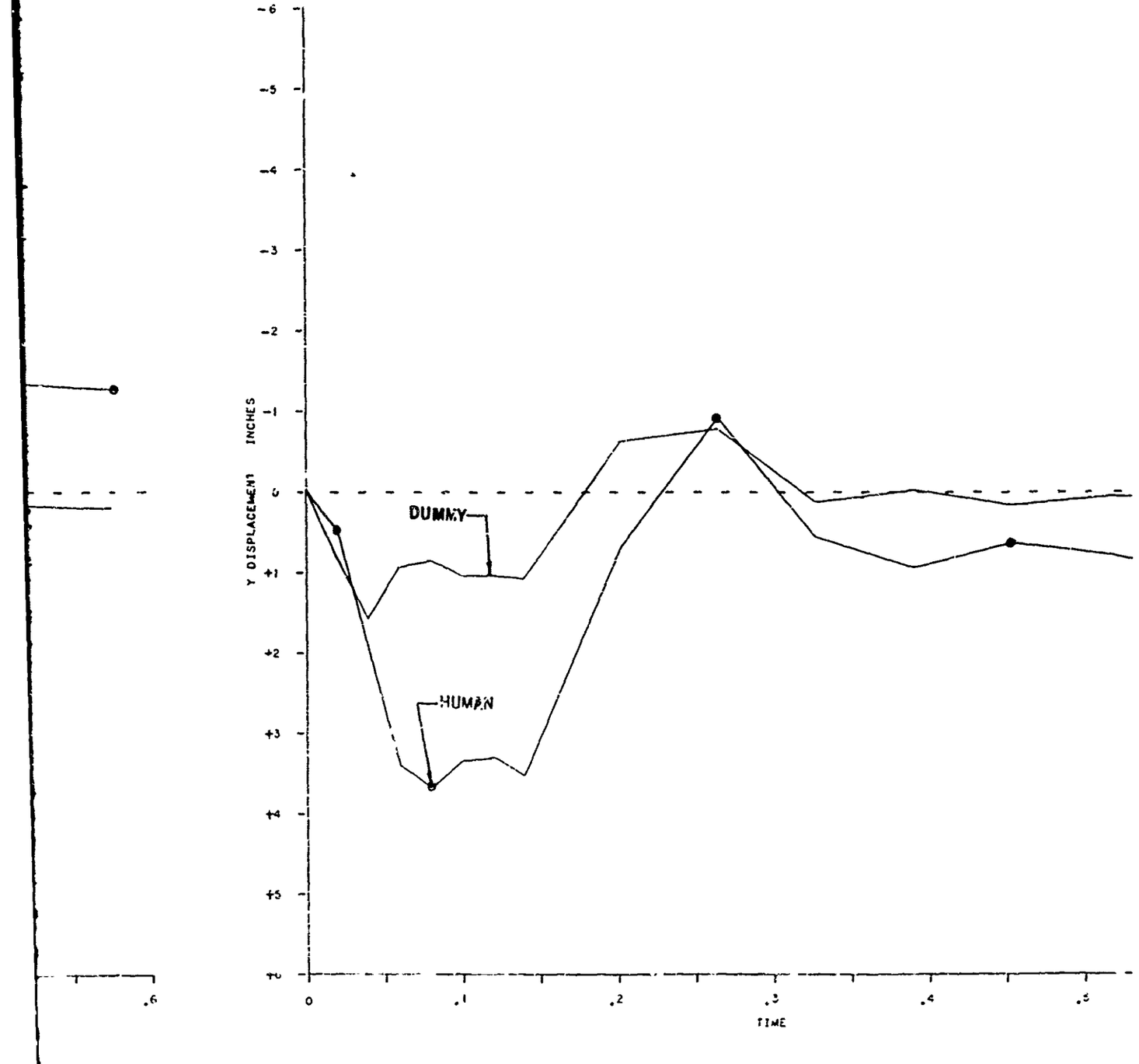


B

SUBJECTS - REED &
SHOULDER POINT - TE

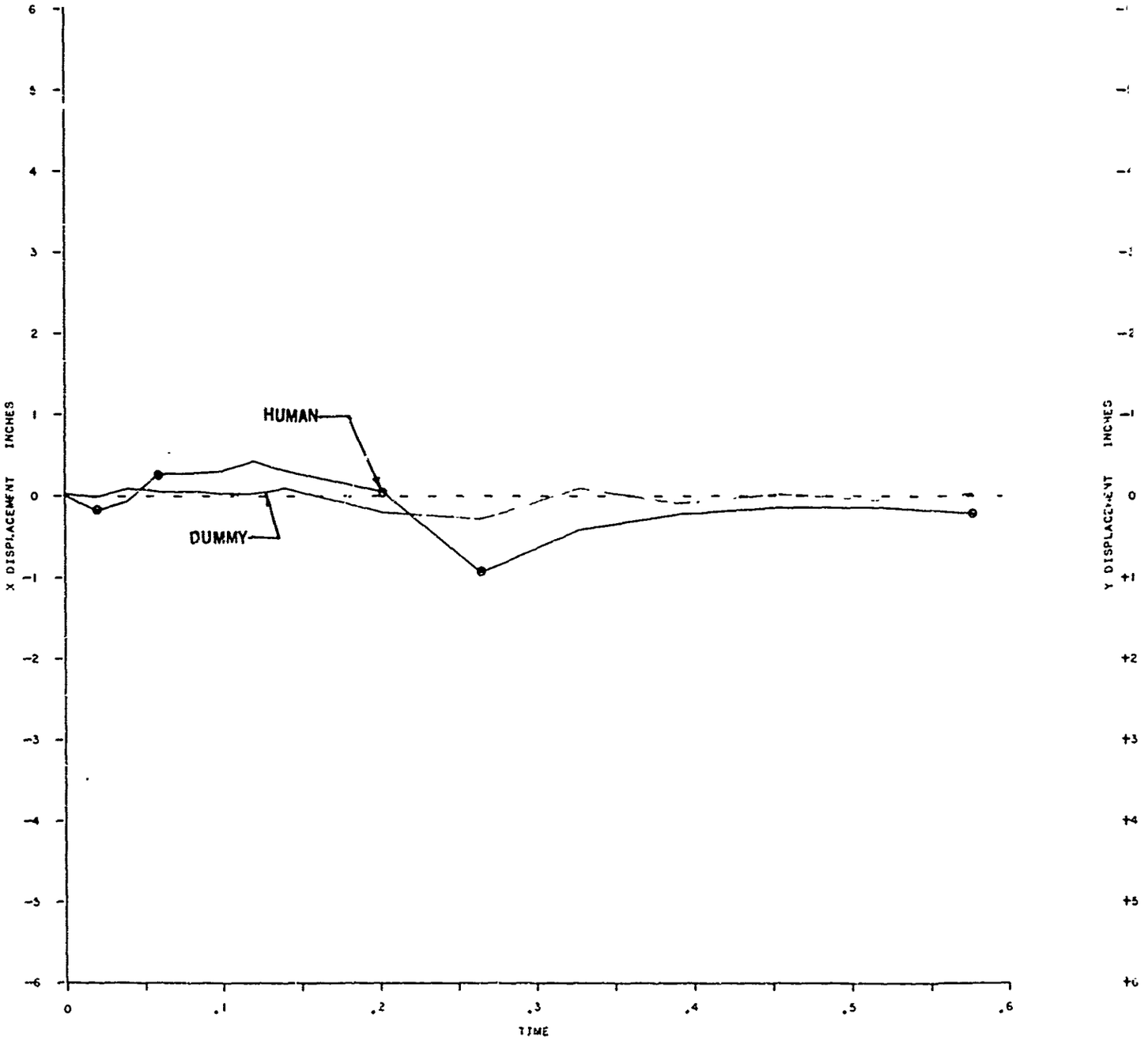


- REED & 5%TILE DUMMY
POINT - TEST NO. 43 --9.0 G

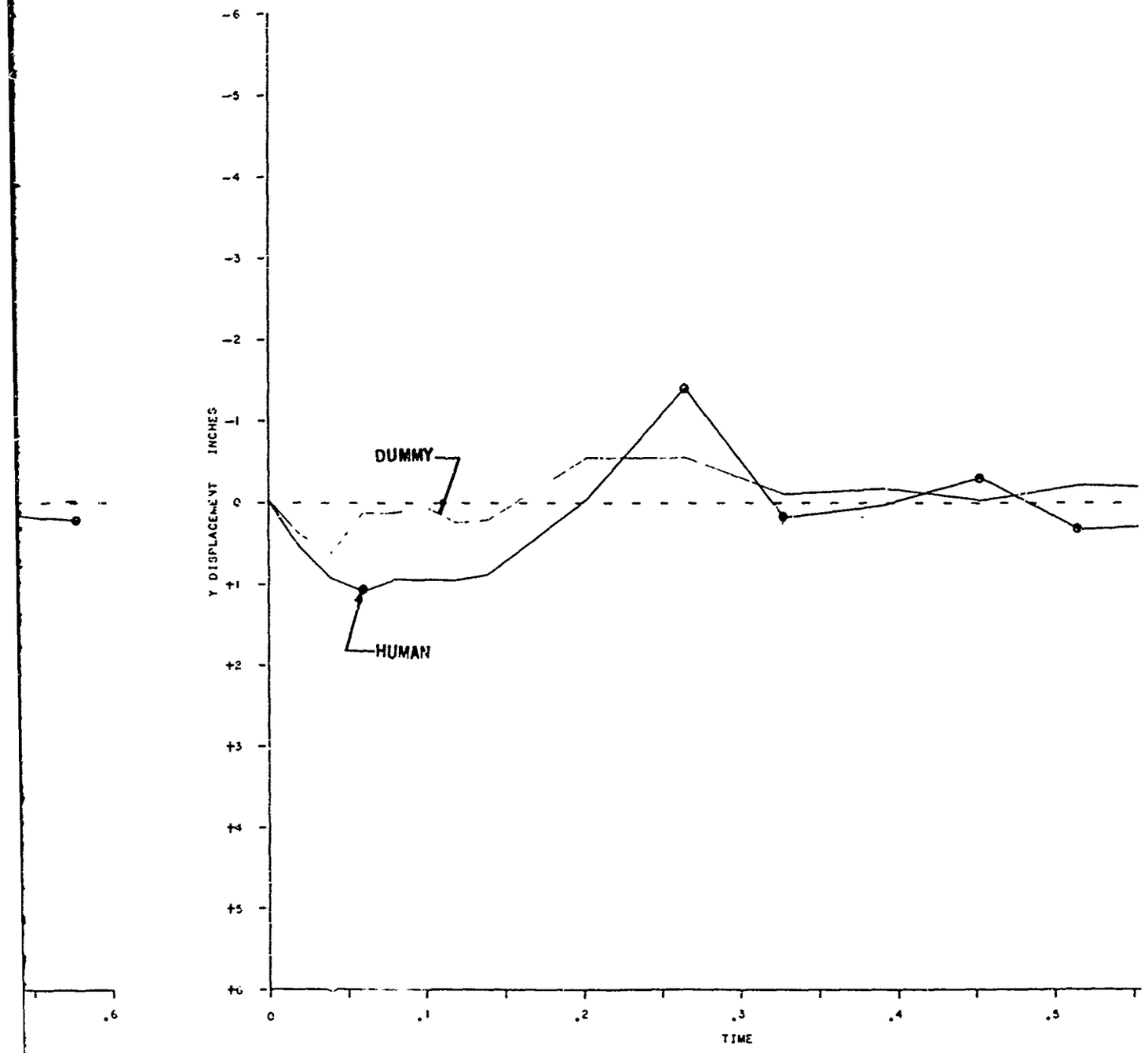


B

SUBJECTS -
THIGH POI

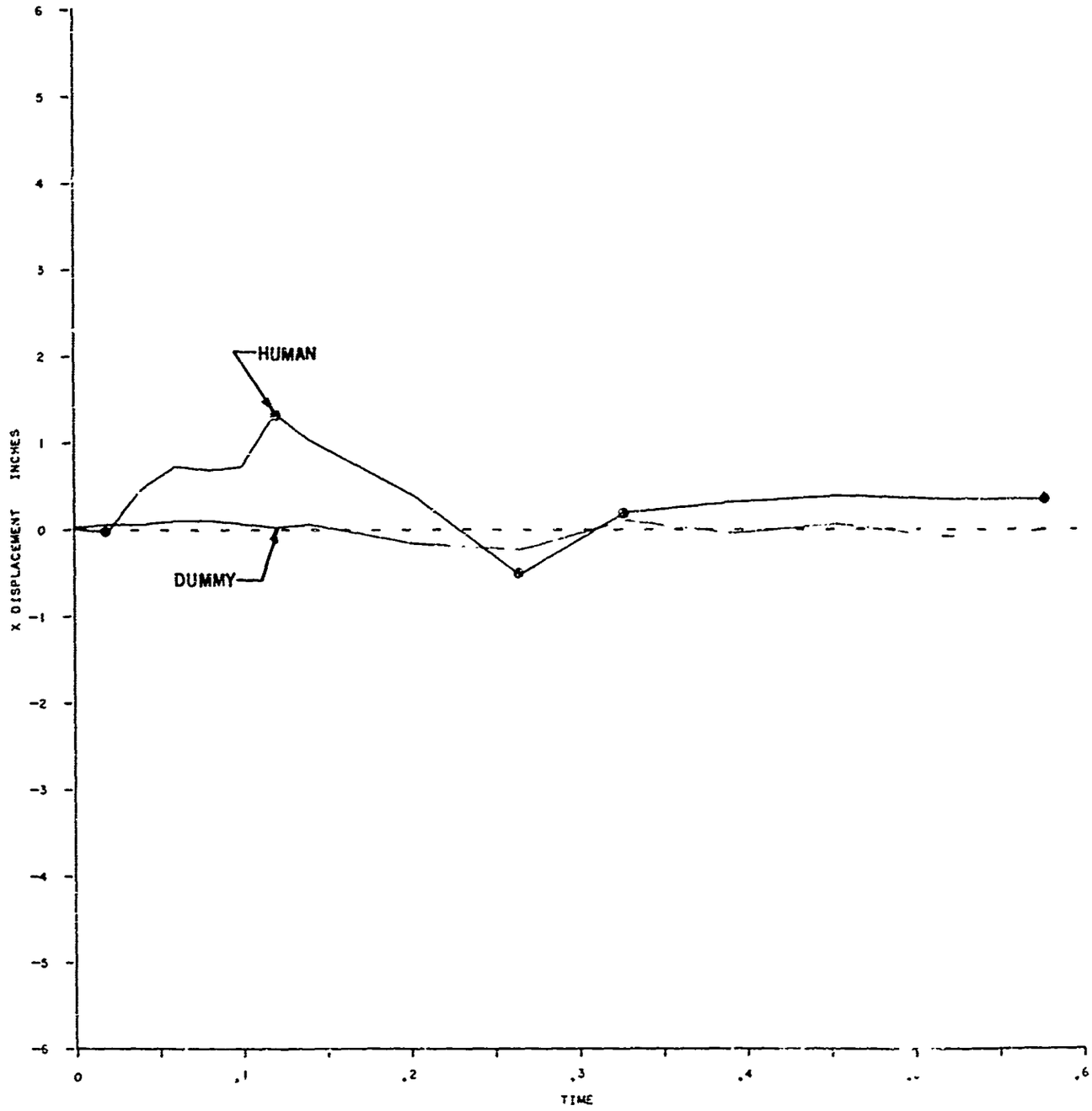


UBJECTS - REED & 5%TILE DUMMY
THIGH POINT - TEST NO. 43 - 9.0G

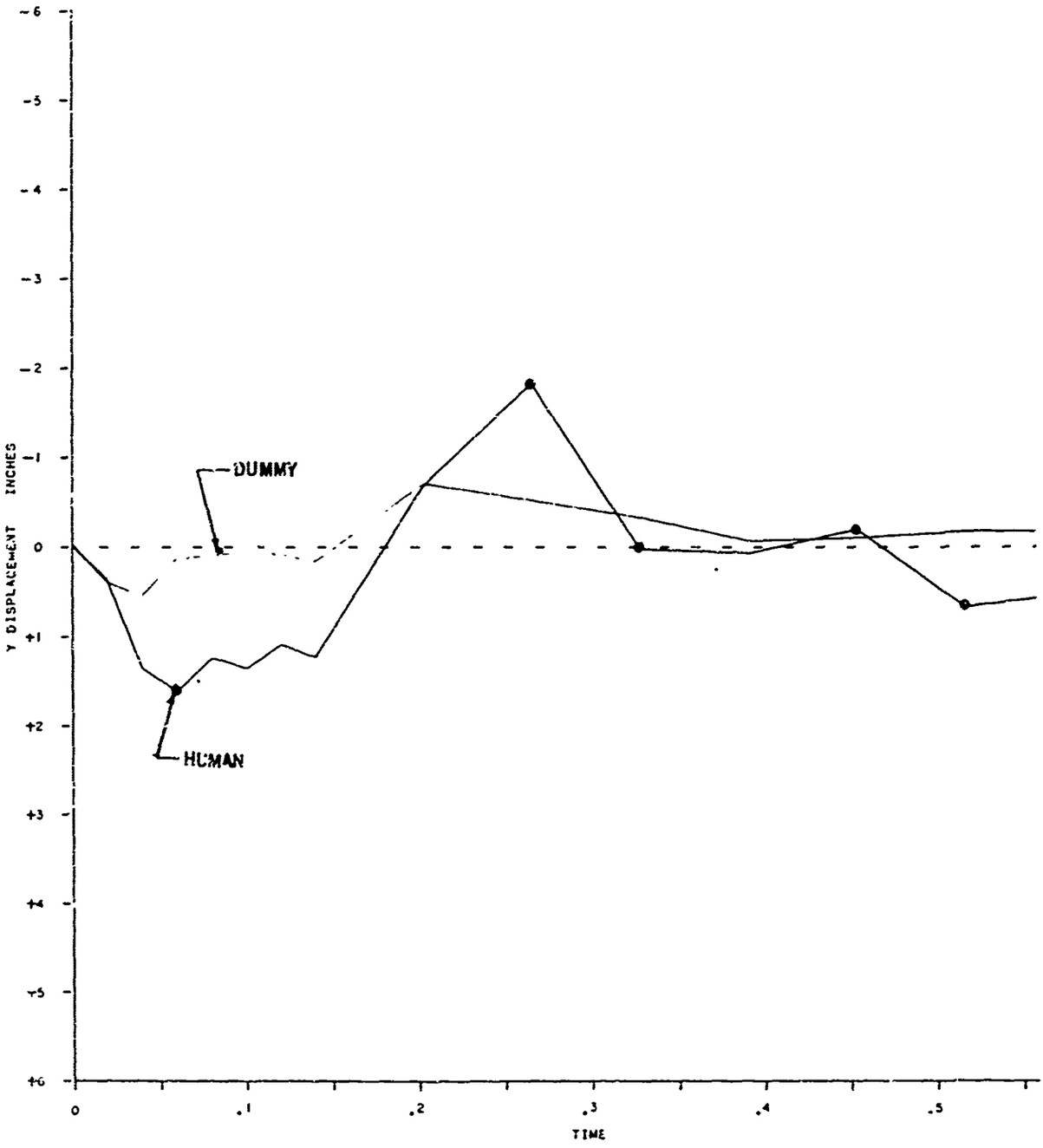


B

SUBJECTS --REED & 5
KNEE POINT - TEST

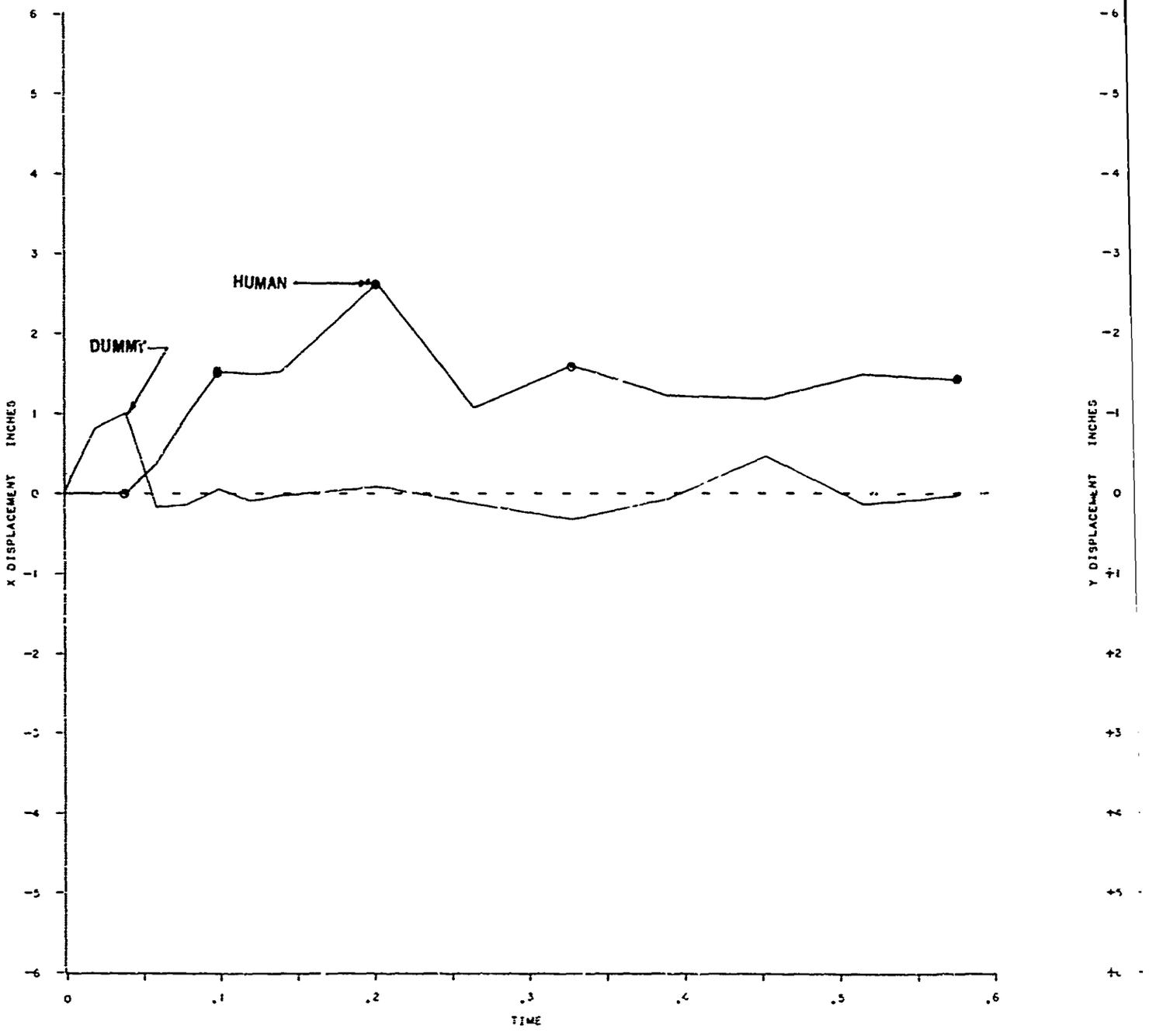


REED & 5%TILE DUMMY
TEST NO. 43 - 9.0 G

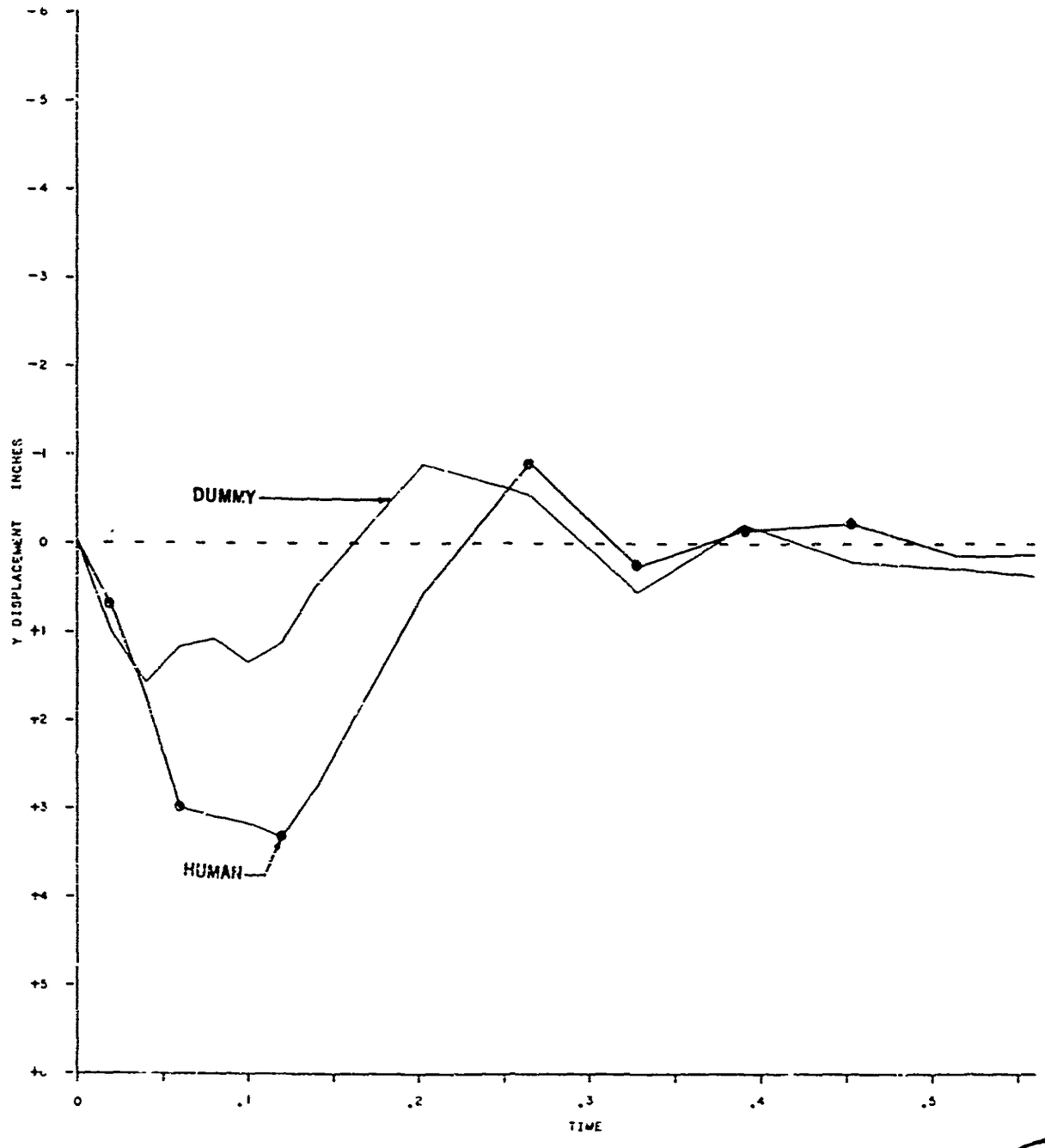


B

SUBJECTS - REED &
SHOULDER POINT - TES

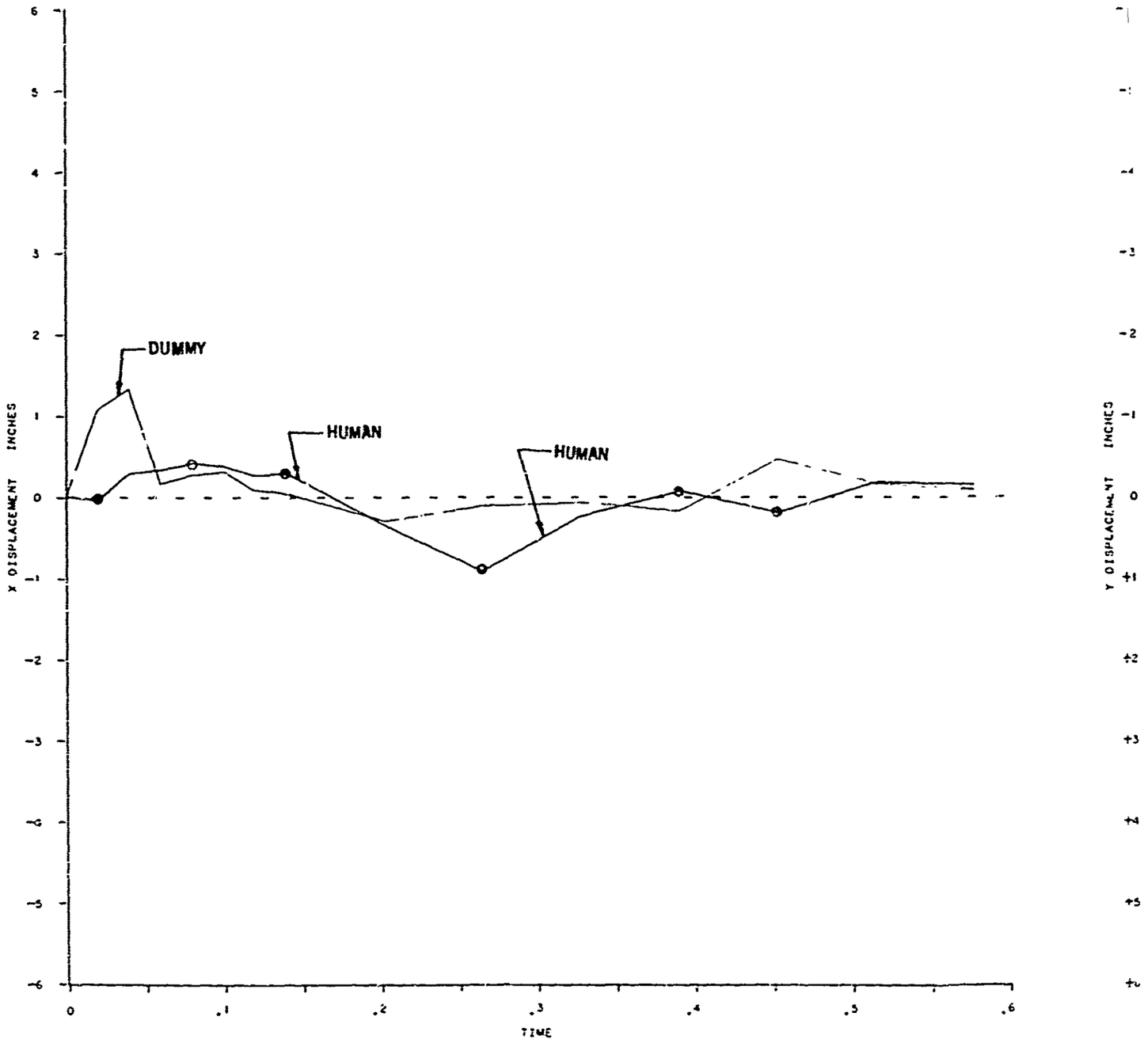


REED & 5%TILE DUMMY
NT - TEST NO. 44 - 10.0 G

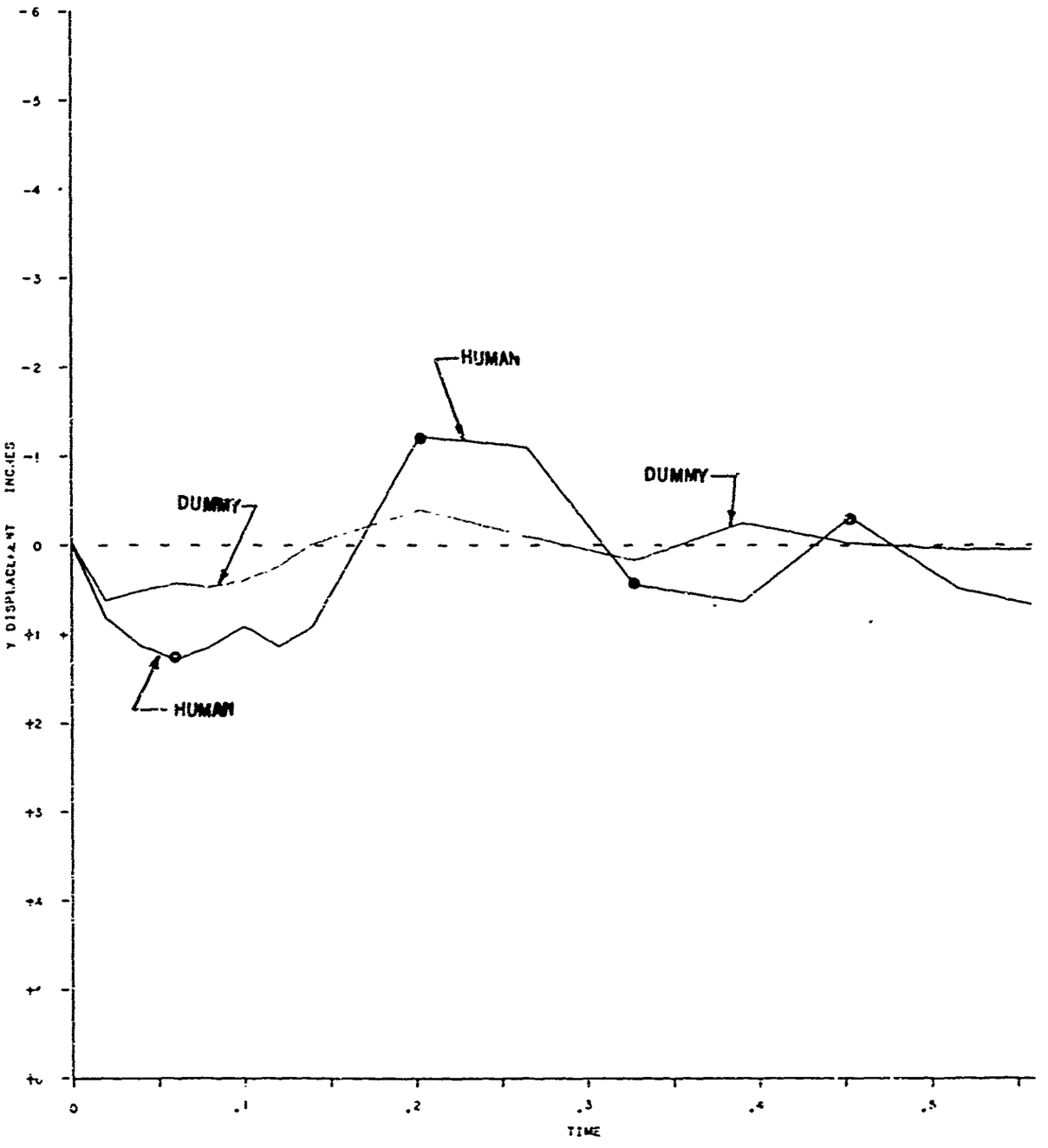


B

SUBJECTS - REED & 5%TILE
THIGH POINT - TEST NO. 44

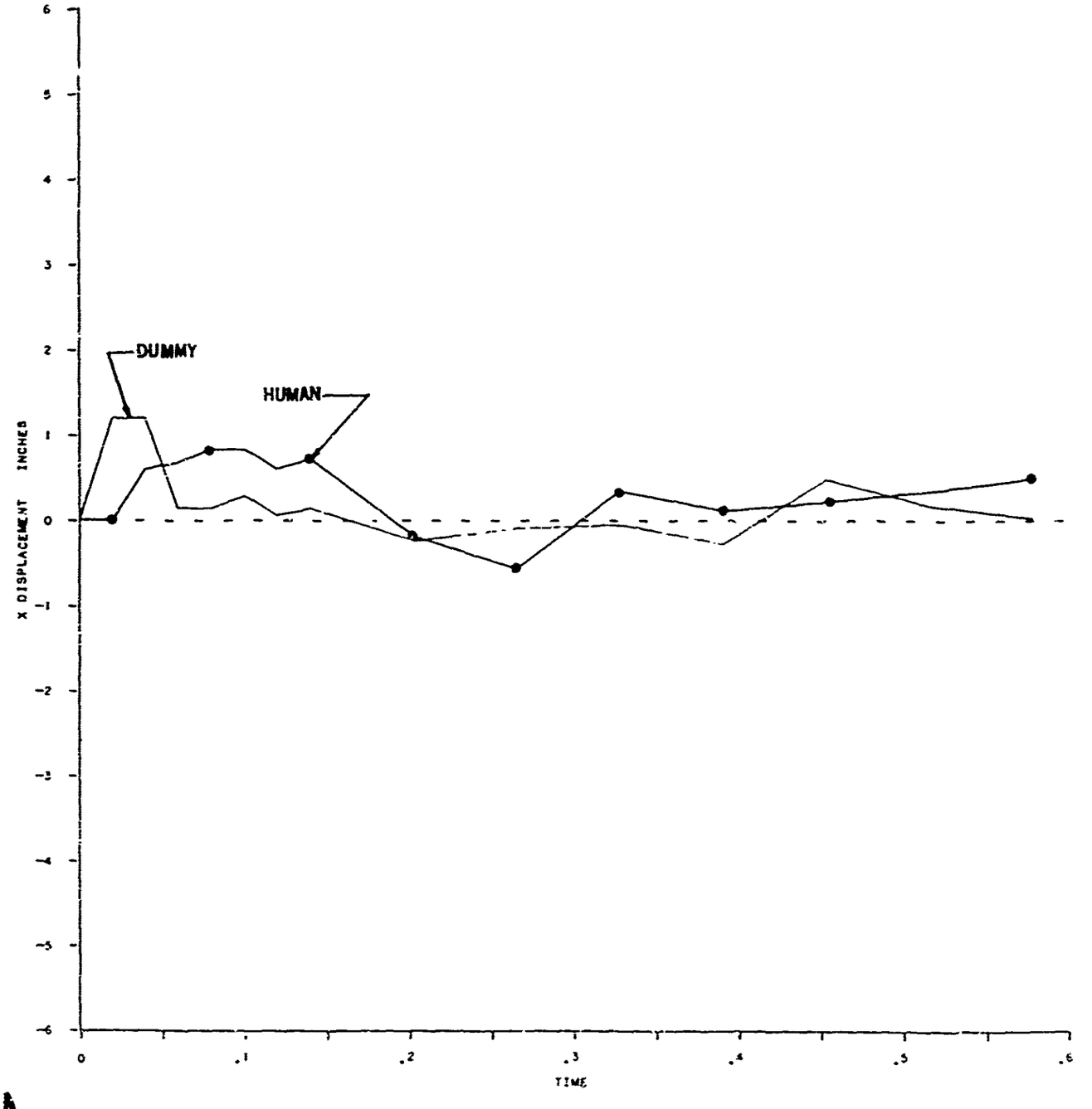


& 5%TILE DUMMY
T NO. 44 - 10.0 G

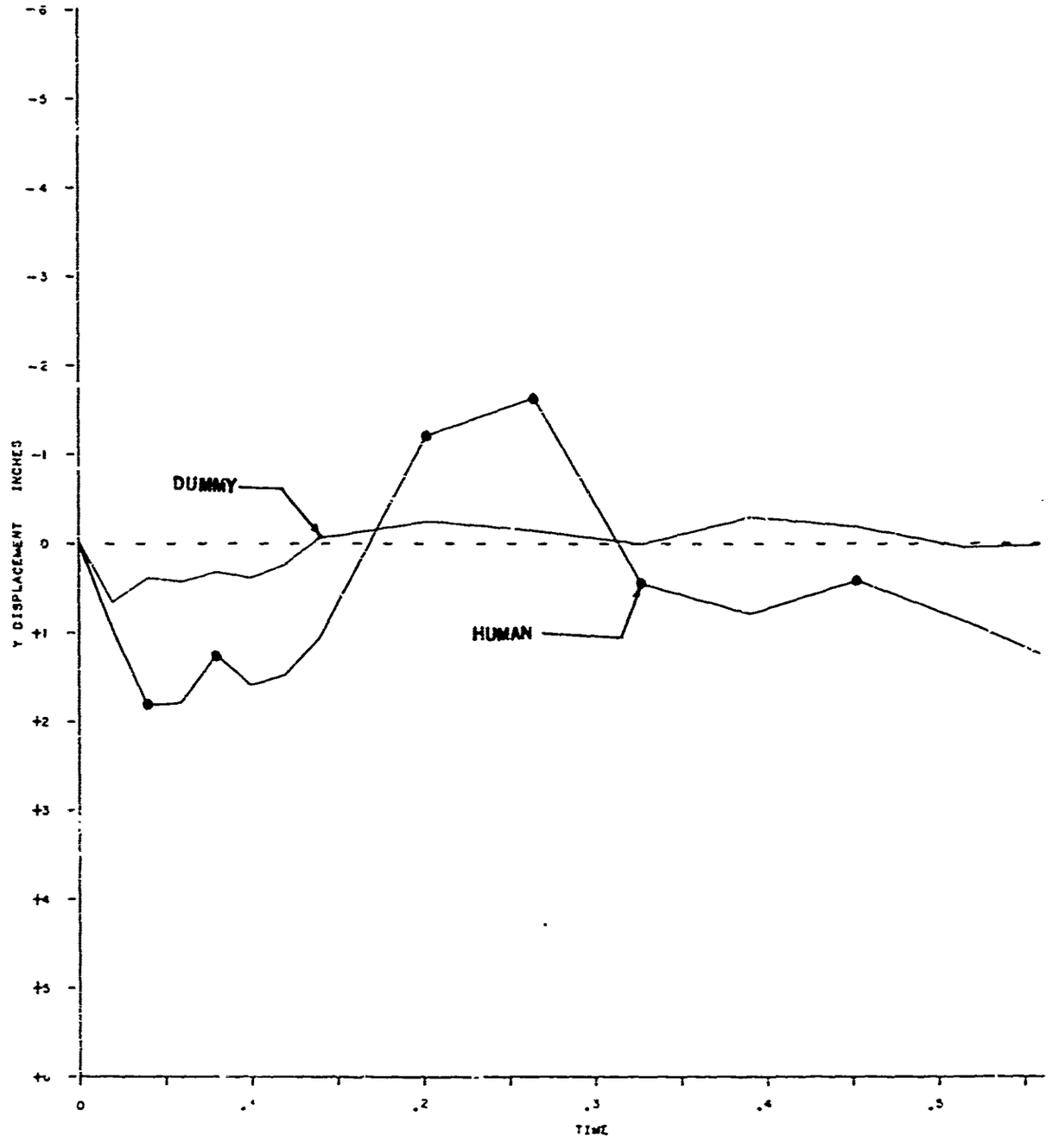


B

SUBJECTS - REED & KNEE POINT - TEST



ED & 5%TILE DUMMY
TEST NO. 44 - 10.0 G



B

ANTHROPOMETRIC DATA

	ANTHROPOMETRY			REED		BRICE		BROOKS	
	5%ILE	50%ILE	95%ILE	MEASURE	%ILE	MEASURE	%ILE	MEASURE	%ILE
Weight (Lbs.)	140.32	171.1	203.58	130.0	-1	150.0	13.8	205.0	96.8
Height (Inches)	66.22	69.87	73.91	68.2	23.5	69.2	38.5	73.8	94.5
Functional Reach (Inches)	29.33	31.40	34.04	31.5	52.5	32.2	70.5	33.7	92.5
Sitting Height (Inches)	34.24	36.27	38.36	35.3	21.8	37.2	77.0	39.1	99.0
Shoulder Width - Bideltoid Diam. (Inches)	17.28	18.78	20.26	16.2	-1	18.5	37.0	20.7	98.2
Trunk Height (Shoulder Height Sitting) (Inches)	22.03	23.8	25.54	25.3	92.6	24.9	84.8	27.5	99+
Buttock Knee Length (Inches)	22.5	24.06	25.80	22.7	7.2	23.2	18.0	25.4	89.6
Leg Length (Crotch Height) (Inches)	30.65	33.15	35.99	40.6	15.6	40.9	20.0	35.7	94.0

TABLE I

NADC-AC-6808

TABLE II

TABULATED DISPLACEMENT DATA SHOWING BODY MOVEMENT OF

C. BROOKS AND 95 PERCENTILE DUMMY

TEST SUBJECT AME-3 C. BROOKS

		TEMPLE					EYE					NOSE			
TEST NO	PT NO	TIME	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY
34	0	.0000	19.36	32.54	.00-	.00	19.97	31.51	.00-	.00	21.60	30.11	.00-	.00
34	1	.0200	19.25	32.16	.11-	.38	19.86	31.13	.11-	.38	21.53	29.69	.07-	.42
34	2	.0400	19.36	31.59	.00-	.95	19.82	30.64	.15-	.87	21.49	29.16	.11-	.95
34	3	.0600	19.06	31.59	.30-	.95	19.74	30.26	.23-	1.25	21.34	28.86	.26-	1.25
34	4	.0800	19.21	31.13	.15-	1.41	19.78	29.96	.19-	1.55	21.41	28.55	.19-	1.56
34	5	.1000	19.13	31.48	.23-	1.06	19.82	30.07	.15-	1.44	21.49	28.63	.11-	1.48
34	6	.1200	19.13	31.70	.23-	.84	19.82	30.38	.15-	1.13	21.45	28.93	.15-	1.18
34	7	.1400	19.17	31.55	.19-	.99	19.86	30.22	.11-	1.29	21.49	28.74	.11-	1.37
34	8	.2025	19.13	31.36	.23-	1.18	19.86	30.07	.11-	1.44	21.49	28.86	.11-	1.25
34	9	.2650	19.29	31.10	.07-	1.44	19.97	29.84	.00-	1.67	21.60	28.48	.00-	1.63
34	10	.3275	19.21	31.40	.15-	1.14	19.86	30.00	.11-	1.51	21.64	28.55	.04	1.56
34	11	.3900	19.06	31.51	.30-	1.03	19.70	30.19	.27-	1.32	21.41	28.97	.19-	1.14
34	12	.4525	18.91	32.62	.45-	.08-	19.67	31.55	.30-	.04-	21.41	29.96	.19-	.15
34	13	.5150	19.17	32.62	.19-	.08-	19.89	31.48	.08-	.03	21.56	29.88	.04-	.23
34	14	.5775	18.94	32.24	.42-	.30	19.55	31.13	.42-	.38	21.34	29.62	.26-	.49

		SHOULDER					THIGH					KNEE			
TEST NO	PT NO	TIME	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY
34	0	.0000	15.91	27.26	.00-	.00	30.87	5.88	.00-	.00	42.15	7.02	.00-	.00
34	1	.0200	15.79	26.88	.12-	.38	30.79	5.58	.08-	.30	42.00	6.56	.15-	.46
34	2	.0400	15.98	26.12	.07	1.14	30.83	5.39	.04-	.49	42.15	6.26	.00-	.76
34	3	.0600	15.87	25.40	.04-	1.86	30.91	5.39	.04	.49	42.03	6.60	.12-	.42
34	4	.0800	15.68	25.02	.23-	2.24	31.02	5.05	.15	.83	42.34	6.60	.19	.42
34	5	.1000	15.64	25.17	.27-	2.09	30.94	4.97	.07	.91	42.45	6.26	.30	.76
34	6	.1200	15.60	25.44	.31-	1.82	31.06	5.35	.19	.53	42.38	6.37	.23	.65
34	7	.1400	15.83	25.25	.08-	2.01	31.06	5.31	.19	.57	42.34	6.37	.19	.65
34	8	.2025	16.13	25.13	.22	2.13	30.79	5.27	.08-	.61	42.19	6.56	.04	.46
34	9	.2650	16.10	24.98	.19	2.28	30.98	5.01	.11	.87	42.41	6.00	.26	1.02
34	10	.3275	16.06	24.83	.15	2.43	31.02	5.20	.15	.68	42.38	6.30	.23	.72
34	11	.3900	16.10	25.06	.19	2.20	30.98	5.43	.11	.45	42.22	6.75	.07	.27
34	12	.4525	15.91	27.00	.00-	.26	31.02	5.54	.15	.34	42.26	7.17	.11	.15-
34	13	.5150	15.91	26.92	.00-	.34	30.83	5.35	.04-	.53	42.19	6.37	.04	.65
34	14	.5775	15.68	25.86	.23-	1.40	30.91	5.39	.04	.49	42.22	6.72	.07	.30

TEST SUBJECT 95%tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
34	0	.0000					19.89	29.62	.00-	.00	20.88	28.32	.00-	.00
34	1	.0200					19.82	29.35	.07-	.27	20.81	28.13	.07-	.19
34	2	.0400					19.93	28.86	.04	.76	20.88	27.45	.00-	.87
34	3	.0600					20.05	28.48	.16	1.14	20.92	27.03	.04	1.29
34	4	.0800					20.12	28.32	.23	1.30	20.96	26.88	.08	1.44
34	5	.1000					20.24	28.55	.35	1.07	21.00	26.88	.12	1.44
34	6	.1200					20.27	28.25	.38	1.37	21.03	26.69	.15	1.63
34	7	.1400					20.27	28.17	.38	1.45	21.00	26.73	.12	1.59
34	8	.2025					20.27	28.17	.38	1.45	21.11	26.84	.23	1.48
34	9	.2650					20.24	28.32	.35	1.30	21.07	27.11	.19	1.21
34	10	.3275					20.31	28.25	.42	1.37	21.11	26.84	.23	1.48
34	11	.3900					20.31	28.48	.42	1.14	21.11	27.22	.23	1.10
34	12	.4525					20.43	29.27	.54	.35	21.22	27.94	.34	.38
34	13	.5150					20.50	29.01	.61	.61	21.30	27.60	.42	.72
34	14	.5775					20.20	29.12	.31	.50	21.00	27.75	.12	.57

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
34	0	.0000	16.55	24.49	.00-	.00	30.49	6.64	.00-	.00	38.50	7.06	.00-	.00
34	1	.0200	16.32	24.00	.23-	.49	30.45	6.22	.04-	.42	38.43	6.79	.07-	.27
34	2	.0400	16.44	23.39	.11-	1.10	30.56	6.00	.07	.64	38.50	6.64	.00-	.42
34	3	.0600	16.29	23.20	.26-	1.29	30.53	6.00	.04	.64	38.46	6.79	.04-	.27
34	4	.0800	16.02	23.24	.53-	1.25	30.49	6.07	.00-	.57	38.39	7.02	.11-	.04
34	5	.1000	16.10	23.46	.45-	1.03	30.53	6.22	.04	.42	38.35	6.87	.15-	.19
34	6	.1200	16.21	23.35	.34-	1.14	30.60	6.03	.11	.61	38.43	6.66	.07-	.38
34	7	.1400	16.32	23.39	.23-	1.10	30.53	6.15	.04	.49	38.43	6.87	.07-	.19
34	8	.2025	16.40	23.54	.15-	.95	30.53	6.18	.04	.46	38.43	6.94	.07-	.12
34	9	.2650	16.21	23.43	.34-	1.06	30.60	6.07	.11	.57	38.50	6.87	.00-	.19
34	10	.3275	16.32	23.35	.23-	1.14	30.53	6.11	.04	.53	38.46	6.83	.04-	.23
34	11	.3900	16.44	24.00	.11-	.49	30.60	6.53	.11	.11	38.46	7.17	.04-	.11-
34	12	.4525	16.32	24.72	.23-	.23-	30.56	6.98	.07	.34-	38.54	7.32	.04	.26-
34	13	.5150	16.44	24.00	.11-	.49	30.56	6.34	.07	.30	38.62	6.94	.12	.12
34	14	.5775	16.06	24.11	.49-	.38	30.56	6.45	.07	.19	38.54	7.13	.04	.07-

TEST SUBJECT AME-3 C. BROOKS

		TEMPLE					EYE				NOSE			
TEST NO	PT NO	TIME	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY
35	0	.0000	18.72	32.84	.00-	.00	19.48	31.63	.00-	.00	21.19	30.38	.00-	.00
35	1	.0200	18.79	32.31	.07	.53	19.59	31.1?	.11	.53	21.15	29.84	.04-	.54
35	2	.0400	18.94	31.29	.22	1.55	19.51	30.07	.03	1.56	21.26	28.78	.07	1.60
35	3	.0600	19.25	30.53	.53	2.31	19.86	29.20	.38	2.43	21.34	28.02	.15	2.36
35	4	.0800	19.44	30.30	.72	2.54	20.05	28.97	.57	2.66	21.68	27.79	.49	2.59
35	5	.1000	19.13	30.56	.41	2.28	20.08	29.27	.60	2.36	21.79	28.25	.60	2.13
35	6	.1200	18.98	30.79	.26	2.05	19.86	29.62	.38	2.01	21.75	28.55	.56	1.83
35	7	.1400	18.94	30.94	.22	1.90	19.93	29.69	.45	1.94	21.64	28.70	.45	1.68
35	8	.2025	18.87	30.72	.15	2.12	19.82	29.50	.34	2.13	21.53	28.44	.34	1.94
35	9	.2650	19.06	31.10	.34	1.74	19.97	29.65	.49	1.98	21.56	28.51	.37	1.87
35	10	.3275	19.70	32.12	.98	.72	20.16	31.13	.68	.50	21.75	29.92	.56	.46
35	11	.3900	19.51	32.31	.79	.53	20.12	31.25	.64	.38	21.64	29.69	.45	.69
35	12	.4525	19.13	31.78	.41	1.06	19.89	30.56	.41	1.07	21.49	29.12	.30	1.26
35	13	.5150	18.60	32.27	.12-	.57	19.48	30.94	.00-	.69	21.15	29.58	.04-	.80
35	14	.5775	19.06	32.31	.34	.53	19.78	31.02	.30	.61	21.53	29.65	.34	.73

		SHOULDER					THIGH				KNEE			
TEST NO	PT NO	TIME	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY
35	0	.0000	16.17	26.05	.00-	.00	30.07	6.18	.00-	.00	41.08	7.13	.00-	.00
35	1	.0200	16.36	25.78	.19	.27	30.03	5.73	.04-	.45	40.97	6.56	.11-	.57
35	2	.0400	16.51	24.56	.34	1.49	30.07	5.46	.00-	.72	41.08	6.26	.00-	.87
35	3	.0600	16.70	23.01	.53	3.04	30.11	5.65	.04	.53	41.39	6.68	.31	.45
35	4	.0800	17.12	22.78	.95	3.27	30.22	5.46	.15	.72	41.62	6.83	.54	.30
35	5	.1000	17.27	23.35	1.10	2.70	30.26	5.39	.19	.79	41.73	6.37	.65	.76
35	6	.1200	17.43	23.77	1.26	2.28	30.22	5.54	.15	.64	41.65	6.18	.57	.95
35	7	.1400	17.65	23.77	1.48	2.28	30.15	5.54	.08	.64	41.39	6.60	.31	.53
35	8	.2025	17.54	24.11	1.37	1.94	30.30	5.84	.23	.34	41.43	7.10	.35	.03
35	9	.2650	17.27	25.13	1.10	.92	30.19	5.62	.12	.56	41.58	6.79	.50	.34
35	10	.3275	16.59	27.49	.42	1.44-	29.92	6.03	.15-	.15	41.12	7.63	.04	.50-
35	11	.3900	16.51	27.53	.34	1.48-	29.77	6.26	.30-	.08-	40.89	7.02	.19-	.11
35	12	.4525	17.01	26.58	.84	.53-	29.81	6.15	.26-	.03	40.86	7.32	.22-	.19-
35	13	.5150	16.36	26.88	.19	.83-	30.03	6.00	.04-	.18	41.20	7.13	.12	.00
35	14	.5775	16.67	26.81	.50	.76-	30.03	5.91	.04-	.27	41.12	6.56	.01	.57

TEST SUBJECT 95%tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
35	0	.0000					20.35	29.20	.00-	.00	21.26	27.45	.00-	.00
35	2	.0200					20.27	28.67	.08-	.53	21.07	27.22	.19-	.23
35	3	.0400					20.12	27.98	.23-	1.22	20.96	26.62	.30-	.83
35	4	.0600					20.31	27.60	.04-	1.60	21.00	26.24	.26-	1.21
35	5	.0800					20.58	27.53	.23	1.67	21.19	26.12	.07-	1.33
35	6	.1000					20.77	27.49	.42	1.71	21.37	25.89	.11	1.56
	7	.1200					20.81	27.34	.46	1.86	21.22	25.74	.04-	1.71
35	8	.1400					20.81	27.19	.46	2.05	21.26	25.70	.00-	1.75
35	9	.2025					21.00	27.11	.65	2.09	21.49	25.74	.23	1.71
35	10	.2650					20.81	28.17	.46	1.03	21.37	26.62	.11	.83
35	11	.3275					20.88	28.82	.53	.38	21.49	27.30	.23	.15
35	12	.3900					21.00	27.98	.65	1.22	21.53	26.46	.27	.99
35	13	.4525					20.81	28.36	.46	.84	21.41	26.77	.15	.68
35	14	.5150					20.96	28.17	.61	1.03	21.53	26.69	.27	.76
35	15	.5775					20.81	28.25	.46	.95	21.45	26.69	.19	.76

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
35	0	.0000	16.59	24.15	.00-	.00	30.72	6.49	.00-	.00	38.73	6.98	.00-	.00
35	2	.0200	16.51	23.62	.08-	.53	30.72	5.88	.00-	.61	38.73	6.53	.00-	.45
35	3	.0400	16.40	22.70	.19-	1.45	30.64	5.58	.08-	.91	38.62	6.45	.11-	.53
35	4	.0600	16.17	22.74	.42-	1.41	30.68	5.73	.04-	.76	38.69	6.79	.04-	.19
35	5	.0800	16.13	23.05	.46-	1.10	30.72	6.03	.00-	.46	38.62	6.91	.11-	.07
35	6	.1000	16.36	22.97	.23-	1.18	30.68	5.84	.04-	.65	38.54	6.56	.19-	.42
35	7	.1200	16.36	22.93	.23-	1.22	30.64	5.77	.08-	.72	38.58	6.60	.15-	.38
35	8	.1400	16.25	23.01	.34-	1.14	30.56	5.96	.16-	.53	38.54	6.79	.19-	.19
35	9	.2025	16.48	23.05	.11-	1.10	30.79	5.92	.07	.57	38.77	6.72	.04	.26
35	10	.2650	16.13	24.11	.46-	.04	30.64	6.64	.08-	.15-	38.65	7.36	.08-	.38-
35	11	.3275	16.10	24.64	.49-	.49-	30.64	7.19	.08-	.61-	38.54	7.82	.19-	.84-
35	12	.3900	16.21	23.62	.38-	.53	30.75	6.03	.03	.46	38.88	6.75	.15	.23
35	13	.4525	16.13	24.15	.46-	.00	30.75	6.72	.03	.23-	38.73	7.36	.00-	.38-
35	14	.5150	16.36	23.96	.23-	.19	30.75	6.34	.03	.15	38.81	6.94	.08	.04
35	15	.5775	16.29	24.00	.30-	.15	30.68	6.37	.04-	.12	38.73	7.02	.00-	.04-

TEST SUBJECT AME-3 C. BROOKS

		TEMPLE				EYE				NOSE			
TEST NO	PT NO	TIME	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY
39	0	.0000	18.53	32.46	.00-	.00	19.40	31.70	.00-	.00	21.30	30.26	.00-	.00
39	1	.0200	18.49	32.12	.04-	.34	19.48	31.21	.08	.49	21.19	29.88	.11-	.38
39	2	.0400	18.69	31.32	.15	1.14	19.59	30.34	.19	1.36	21.30	28.97	.00-	1.29
39	3	.0600	18.83	30.87	.30	1.59	19.74	29.92	.34	1.78	21.30	28.55	.00-	1.71
39	4	.0800	18.91	30.79	.38	1.67	19.82	29.81	.42	1.89	21.53	28.40	.23	1.86
39	5	.1000	18.83	30.79	.30	1.67	19.78	29.81	.38	1.89	21.53	28.40	.23	1.86
39	6	.1200	18.83	30.72	.30	1.74	19.78	29.77	.38	1.93	21.45	28.40	.15	1.86
39	7	.1400	18.87	30.91	.34	1.55	19.78	29.92	.38	1.78	21.60	28.48	.30	1.78
39	8	.2025	18.75	31.21	.22	1.25	19.70	30.34	.30	1.36	21.41	28.97	.11	1.29
39	9	.2650	18.72	32.65	.19	.19-	19.63	31.78	.23	.08-	21.37	30.30	.07	.04-
39	10	.3275	18.75	32.16	.22	.30	19.59	31.32	.19	.38	21.41	30.00	.11	.26
39	12	.3900	18.60	32.08	.07	.38	19.55	31.17	.15	.53	21.30	29.73	.00-	.53
39	13	.4525	18.37	32.16	.16-	.30	19.36	31.32	.04-	.38	21.26	29.92	.04-	.34
39	14	.5150	18.56	32.16	.03	.30	19.40	31.32	.00-	.38	21.26	30.00	.04-	.26
39	15	.5775	18.60	32.05	.07	.41	19.40	31.25	.00-	.45	21.30	29.84	.00-	.42

		SHOULDER				THIGH				KNEE			
TEST NO	PT NO	TIME	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY
39	0	.0000	16.06	27.00	.00-	.00	28.44	6.26	.00-	.00	40.78	7.06	.00-	.00
39	1	.0200	16.02	26.73	.04-	.27	28.36	6.03	.08-	.23	40.70	6.72	.08-	.34
39	2	.0400	16.02	25.86	.04-	1.14	28.48	5.96	.04	.30	40.89	6.37	.11	.69
39	3	.0600	15.94	25.10	.12-	1.90	28.70	6.03	.26	.23	41.08	6.87	.30	.19
39	4	.0800	15.83	24.72	.23-	2.28	28.74	5.92	.30	.34	41.24	6.83	.46	.23
39	5	.1000	15.68	24.79	.38-	2.21	28.78	5.81	.34	.45	41.31	6.49	.53	.57
39	6	.1200	15.79	24.72	.27-	2.28	28.74	5.77	.30	.49	41.20	6.26	.42	.80
39	7	.1400	15.98	24.83	.08-	2.17	28.74	5.81	.30	.45	41.12	6.56	.34	.50
39	8	.2025	16.17	25.29	.11	1.71	28.74	5.96	.30	.30	41.05	7.10	.27	.04-
39	9	.2650	16.32	27.26	.26	.26-	27.98	6.26	.46-	.00	40.21	7.78	.57-	.72-
39	10	.3275	16.17	26.69	.11	.31	28.02	6.92	.42	.34	40.55	7.02	.23-	.04
39	12	.3900	15.75	26.35	.31-	.65	28.48	6.18	.04	.08	40.78	7.59	.00-	.53-
39	13	.4525	15.98	26.58	.08-	.42	28.29	6.11	.19-	.15	40.36	7.63	.42-	.57
39	14	.5150	15.91	26.62	.15-	.38	28.48	6.07	.04	.19	41.12	6.64	.34	.42
39	15	.5775	15.91	26.58	.15-	.42	28.36	6.07	.08-	.19	40.78	7.13	.00-	.07

TEST SUBJECT 95%til• DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
39	0	.0000									20.96	28.29	.00-	.00
39	1	.0200									21.00	28.17	.04	.12
39	2	.0400									21.00	27.26	.04	1.03
39	3	.0600									21.00	26.39	.04	1.90
39	4	.0800									21.22	26.12	.26	2.17
39	5	.1000									21.41	25.86	.45	2.43
39	6	.1200									21.45	25.74	.49	2.55
39	7	.1400									21.49	25.70	.53	2.59
39	8	.2025									21.56	26.20	.60	2.09
39	9	.2650									21.72	27.26	.76	1.03
39	10	.3275									21.60	26.54	.64	1.75
39	11	.3900									21.68	26.92	.72	1.37
39	12	.4525									21.64	26.69	.68	1.60
39	13	.5150									21.60	26.81	.64	1.48
39	14	.5775									21.68	26.77	.72	1.52

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
39	0	.0000	16.44	23.69	.00-	.00	30.19	6.64	.00-	.00	38.69	7.02	.00-	.00
39	1	.0200	16.40	23.24	.04-	.45	30.11	6.15	.08-	.49	38.73	6.53	.04	.49
39	2	.0400	16.36	22.48	.08-	1.21	30.15	5.69	.04-	.95	38.65	6.15	.04-	.87
39	3	.0600	16.10	22.13	.34-	1.56	30.15	5.69	.04-	.95	38.77	6.45	.08	.57
39	4	.0800	15.94	22.44	.50-	1.25	30.15	5.88	.04-	.76	38.65	6.75	.04-	.27
39	5	.1000	16.02	22.44	.42-	1.25	30.07	5.77	.12-	.87	38.62	6.53	.07-	.49
39	6	.1200	16.13	22.21	.31-	1.48	30.15	5.69	.04-	1.02	38.62	6.22	.07-	.80
39	7	.1400	16.13	22.40	.31-	1.29	30.11	5.77	.00-	.87	38.65	6.49	.04-	.53
39	8	.2025	16.21	23.31	.23-	.38	30.22	6.41	.03	.23	38.69	7.02	.00-	.00
39	9	.2650	16.21	24.15	.23-	.46-	29.81	7.17	.38-	.53-	38.39	7.82	.30-	.80-
39	10	.3275	16.17	23.16	.27-	.53	29.96	6.34	.23-	.30	38.58	6.98	.11-	.04
39	11	.3900	16.29	23.73	.15-	.04-	29.96	6.68	.23-	.04-	38.58	7.17	.11-	.15-
39	12	.4525	16.29	23.35	.15-	.34	30.03	6.53	.16-	.11	38.58	6.94	.11-	.00
39	13	.5150	16.44	23.46	.00-	.23	30.19	6.45	.00-	.19	38.69	6.87	.00-	.15
39	14	.5775	16.32	23.46	.12-	.23	30.11	6.45	.08-	.19	38.69	6.87	.00-	.15

TEST SUBJECT AME-3 C. BROOKS

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
40	0	.0000	18.45	32.65	.00-	.00	19.67	31.51	.00-	.00	21.49	30.00	.00-	.00
40	1	.0200	18.60	32.35	.15	.30	19.67	31.13	.00-	.38	21.49	29.50	.00-	.50
40	2	.0400	18.53	31.36	.08	1.29	19.63	29.73	.04-	1.78	21.34	28.40	.15-	1.60
40	3	.0600	18.94	29.96	.49	2.69	19.89	29.01	.22	2.50	21.72	27.53	.23	2.47
40	4	.0800	19.13	30.03	.68	2.62	20.12	29.05	.45	2.46	21.91	27.72	.42	2.26
40	5	.1000	19.21	30.19	.76	2.46	20.39	29.27	.72	2.24	22.32	28.02	.83	1.98
40	6	.1200	19.36	30.07	.91	2.58	20.54	29.31	.87	2.20	22.44	28.10	.95-	1.90
40	7	.1400	19.17	30.07	.72	2.58	20.39	29.35	.72	2.16	22.40	28.17	.91	1.83
40	8	.2025	19.10	32.35	.65	.30	20.08	31.40	.41	.11	22.06	29.96	.57	.04
40	9	.2650	18.72	32.65	.27	.00	19.67	31.93	.00-	.42-	21.60	30.53	.11	.53-
40	10	.3275	18.53	31.93	.08	.72	19.59	31.10	.08-	.41	21.56	29.81	.07	.19
40	11	.3900	18.91	31.93	.46	.72	19.86	31.06	.19	.45	21.75	29.54	.26	.46
40	12	.4525	18.68	32.16	.23	.49	19.59	31.44	.08-	.07	21.45	30.11	.04-	.11-
40	13	.5150	19.02	32.01	.57	.64	19.97	31.10	.30	.41	21.83	29.62	.34	.60
40	14	.5775	18.75	32.12	.30	.53	19.74	31.29	.07	.22	21.45	29.77	.04-	.23

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
40	0	.0000	15.98	26.96	.00-	.00	31.86	5.50	.00-	.00	41.58	5.35	.00-	.00
40	1	.0200	15.98	26.58	.00-	.38	32.01	5.12	.15	.38	41.65	4.82	.07	.53
40	2	.0400	16.06	24.98	.08	1.98	31.93	4.97	.07	.53	41.84	4.40	.26	.95
40	3	.0600	16.02	23.54	.04	3.42	32.12	5.12	.26	.38	42.11	4.93	.53	.42
40	4	.0800	16.29	23.39	.31	3.57	32.24	5.16	.38	.34	42.38	5.12	.80	.23
40	5	.1000	16.74	23.58	.76	3.38	32.20	4.89	.34	.61	42.30	4.48	.72	.87
40	6	.1200	17.27	23.54	1.29	3.42	32.27	4.89	.41	.61	42.30	4.36	.72	.99
40	7	.1400	17.58	23.69	1.60	3.27	32.20	5.20	.34	.30	42.19	5.12	.61	.23
40	8	.2025	16.99	26.88	.95	.08	32.20	5.96	.34	.46-	41.58	6.79	.00-	1.44-
40	9	.2650	16.67	27.30	.69	.34-	31.13	6.64	.73-	1.14-	41.20	6.45	.38-	1.10-
40	10	.3275	16.40	26.73	.42	.23	31.55	5.46	.31-	.04	41.54	5.01	.04-	.34
40	11	.3900	16.13	26.54	.15	.42	31.70	5.96	.16-	.46-	41.54	6.83	.04-	1.48-
40	12	.4525	16.25	26.73	.27	.23	31.70	5.54	.16-	.04-	41.50	5.50	.08-	.15-
40	13	.5150	16.36	26.58	.38	.38	31.86	5.62	.00-	.12-	41.58	5.43	.00-	.08-
40	14	.5775	16.25	26.69	.27	.27	31.78	5.50	.08-	.08-	41.65	5.84	.07	.49-

TEST SUBJECT 95% tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
40	0	.0000									21.15	28.10	.00-	.00
40	1	.0200									21.00	27.53	.15-	.57
40	2	.0400									20.92	26.58	.23-	1.52
40	3	.0600									21.07	25.78	.08-	2.32
40	4	.0800									21.34	25.36	.19	2.74
40	5	.1000									21.79	25.13	.64	2.97
40	6	.1200									21.56	24.79	.41	3.31
40	7	.1400									21.87	25.06	.72	3.04
40	8	.2025									21.79	27.11	.64	.99
40	9	.2650									21.49	26.31	.34	1.79
40	10	.3275									21.64	26.35	.49	1.75
40	11	.3900									21.37	26.96	.22	1.14
40	12	.4525									21.60	26.62	.45	1.48

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
40	0	.0000	16.25	23.77	.00-	.00	30.34	6.60	.00-	.00	38.58	7.10	.00-	.00
40	1	.0200	16.21	23.05	.04-	.72	30.30	6.03	.04-	.57	38.54	6.60	.04-	.50
40	2	.0400	16.06	22.13	.19-	1.64	30.34	5.50	.00-	1.10	38.50	6.22	.08-	.88
40	3	.0600	15.68	22.10	.57-	1.67	30.38	5.69	.04	.91	38.50	6.68	.08-	.42
40	4	.0800	15.79	22.36	.46-	1.41	30.26	5.77	.08-	.83	38.46	6.68	.12-	.42
40	5	.1000	15.98	22.21	.27-	1.56	30.34	5.58	.00-	1.02	38.50	6.34	.08-	.76
40	6	.1200	16.02	22.17	.23-	1.60	30.34	5.77	.00-	.83	38.46	6.45	.12-	.65
40	7	.1400	16.17	22.67	.08-	1.10	30.45	6.00	.11	.60	38.54	6.91	.04-	.19
40	8	.2025	16.51	24.64	.26	.87-	30.22	7.63	.12-	1.03-	38.43	8.35	.15-	1.25-
40	9	.2650	16.06	23.62	.19-	.15	30.03	6.96	.31-	.38-	38.16	7.89	.42-	.79-
40	10	.3275	16.13	23.12	.12-	.65	30.41	6.11	.07	.49	38.73	6.45	.15	.65
40	11	.3900	16.02	23.92	.23-	.15-	30.11	6.98	.23-	.38-	38.31	7.82	.27-	.72-
40	12	.4525	16.40	23.43	.15	.34	30.34	6.72	.00-	.15-	38.46	7.32	.12-	.22-

TEST SUBJECT AME-3 C. BROOKS

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
60	0	.0000	18.34	32.76	.00-	.00	18.96	31.92	.00-	.00	20.92	30.57	.00-	.00
60	1	.0200					19.34	31.38	.38	.54	20.92	30.42	.00-	.15
60	2	.0400	18.53	32.03	.19	.73	19.15	30.53	.19	1.39	20.80	29.57	.12-	1.00
60	3	.0600	18.76	31.00	.42	1.76	19.69	29.88	.73	2.04	20.92	28.53	.00-	2.04
	4	.0800	18.80	31.23	.46	1.53	19.69	29.61	.73	2.31	21.30	28.30	.38	2.27
60	5	.1000	19.03	31.57	.69	1.19	19.76	30.00	.80	1.92	21.03	28.73	.11	[illegible]
60	6	.1200	18.80	31.15	.46	1.61	19.61	30.03	.65	1.89	20.96	28.69	.04	1.88
60	7	.1400	18.80	31.30	.46	1.46	19.69	30.00	.73	1.92	21.38	28.76	.46	[illegible]
60	8	.2025	18.61	32.84	.27	.08-	19.38	31.80	.42	.12	20.96	30.65	.04	.08-
60	9	.2650	18.61	33.30	.27	.54-	19.42	32.30	.46	.38-	20.96	31.42	.04	.85-
60	10	.3275	18.38	32.38	.04	.38	19.07	31.34	.11	.58	20.92	30.30	.00-	.27
60	11	.3900	18.53	32.73	.19	.03	19.46	31.34	.50	.58	20.88	30.26	.04-	.31
60	12	.4525	18.23	32.69	.11-	.07	19.19	31.50	.23	.42	20.84	30.57	.08-	[illegible]
60	13	.5150	18.42	32.84	.08	.08-	19.19	31.65	.23	.27	21.03	30.42	.11	.15
60	14	.5775	18.26	32.84	.08-	.08-	19.46	31.73	.50	.19	20.76	30.73	.16-	[illegible]
60	15	.6400	18.46	32.42	.12	.34	18.96	31.88	.00-	.04	20.80	30.65	.12-	.08-

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
60	0	.0000	15.61	27.19	.00-	.00	32.57	6.92	.00-	.00	40.34	8.15	.00-	.00
60	1	.0200	15.84	27.15	.23	.04	32.69	6.61	.12	.31	40.53	7.65	.19	.50
60	2	.0400	15.76	25.96	.15	1.23	32.69	6.15	.12	.77	40.53	7.19	.19	.96
60	3	.0600	15.46	24.96	.15-	2.23	32.88	6.38	.31	.54	40.88	7.38	.54	.77
60	4	.0800	15.19	24.46	.42-	2.73	33.00	6.11	.43	.81	41.15	7.46	.81	.69
60	5	.1000	15.07	24.73	.54-	2.46	32.92	6.03	.35	.89	41.03	7.30	.69	.85
60	6	.1200	15.38	24.80	.23-	2.39	32.96	6.03	.39	.89	41.11	7.15	.77	1.00
60	7	.1400	15.73	24.65	.12	2.54	33.00	6.07	.43	.85	41.03	7.34	.69	.81
60	8	.2025	15.26	26.92	.35-	.27	32.46	7.46	.11-	.54-	40.15	9.11	.19-	.96-
60	9	.2650	15.84	27.42	.23	.23-	31.76	7.96	.81-	1.04-	40.00	9.23	.34-	1.08-
60	10	.3275	15.73	26.57	.12	.62	32.34	6.65	.23-	.27	40.61	7.23	.27	.92
60	11	.3900	15.65	26.53	.04	.66	32.39	6.[illegible]	.19-	.23	40.69	7.50	.35	.65
60	12	.4525	15.50	26.88	.11-	.31	32.15	[illegible]	.42-	.65-	39.96	9.15	.38-	1.00
60	13	.5150	15.76	26.96	.15	.23	32.38	[illegible]	.19-	.08	40.30	7.84	.04-	.31
60	14	.5775	15.73	26.92	.12	.27	32.46	[illegible]	.11-	.31-	40.34	8.23	.00-	.06
60	15	.6400	15.53	26.80	.08-	.39	32.34	[illegible]	.23-	.31-	40.19	8.34	.15-	.19-

TEST SUBJECT 95%til. DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
60	0	.0000	19.26	31.50	.00-	.00	19.65	30.23	.00-	.00	20.92	28.42	.00-	.00
60	1	.0200	19.38	30.92	.12	.58	19.92	29.65	.27	.58	20.92	27.96	.00-	.46
60	2	.0400	19.42	29.96	.16	1.54	20.11	28.61	.46	1.62	21.00	26.84	.08	1.58
60	3	.0600	19.88	29.30	.62	2.20	20.54	27.84	.69	2.39	21.11	26.15	.19	2.27
60	4	.0800	20.57	29.00	1.31	2.50	20.73	27.73	1.08	2.50	21.23	25.50	.31	2.92
60	5	.1000	20.80	28.69	1.54	2.81	20.80	27.23	1.15	3.00	21.34	25.50	.42	2.92
60	6	.1200	21.26	28.65	2.00	2.85	21.34	27.00	1.69	3.23	21.57	25.07	.65	3.35
60	7	.1400	21.19	28.11	1.93	3.39	21.34	27.03	1.69	3.20	21.61	25.23	.69	3.19
60	8	.2025	21.42	29.53	2.16	1.97	21.26	28.26	1.61	1.97	21.57	26.07	.65	2.35
60	9	.2650	21.61	29.80	2.35	1.70	21.76	28.19	2.11	2.04	22.11	26.57	1.19	1.85
60	10	.3275	21.61	29.15	2.35	2.35	21.88	27.61	2.23	2.62	22.00	25.65	1.08	2.77
60	11	.3900	21.65	29.15	2.39	2.35	21.65	27.65	2.00	2.58	21.96	25.65	1.04	2.77
60	12	.4525	21.57	29.73	2.31	1.77	21.61	28.11	1.96	2.12	21.84	26.38	.92	2.04
60	13	.5150	21.65	29.34	2.39	2.16	21.80	27.65	2.15	2.58	21.88	25.84	.96	2.58
60	14	.5775	21.73	29.53	2.47	1.97	21.80	28.03	2.15	2.20	22.07	26.07	1.15	2.35
60	15	.6400	21.50	29.65	2.24	1.85	21.69	28.00	2.04	2.23	22.07	26.07	1.13	2.35

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
60	0	.0000	16.96	24.19	.00-	.00	30.30	6.69	.00-	.00	38.00	7.11	.00-	.00
60	1	.0200	16.92	23.61	.04-	.58	30.30	6.15	.00-	.54	38.07	6.61	.07	.50
60	2	.0400	16.84	22.73	.12-	1.46	30.50	5.73	.20	.96	37.96	6.34	.04-	.77
60	3	.0600	16.38	22.69	.58-	1.50	30.46	6.00	.16	.69	38.11	6.84	.11	.27
60	4	.0800	16.30	22.96	.66-	1.23	30.42	6.00	.12	.69	37.88	6.80	.12-	.31
60	5	.1000	16.46	22.76	.50-	1.43	30.38	5.88	.08	.81	37.84	6.65	.16-	.46
60	6	.1200	16.69	22.73	.27-	1.46	30.53	6.03	.23	.66	37.92	6.69	.08-	.42
60	7	.1400	16.57	22.88	.39-	1.31	30.53	5.96	.23	.73	38.11	6.69	.11	.42
60	8	.2025	16.84	24.38	.12-	.19-	30.38	7.03	.08	.34-	38.07	7.53	.07	.42-
60	9	.2650	16.88	24.53	.08-	.34-	29.92	7.19	.38-	.50-	37.53	7.88	.47-	.77-
60	10	.3275	16.84	23.46	.12-	.73	30.30	5.92	.00-	.77	38.15	6.42	.15	.69
60	11	.3900	16.80	23.46	.16-	.73	30.26	5.92	.04-	.77	38.03	6.50	.03	.61
60	12	.4525	16.57	24.19	.39-	.00	30.07	6.69	.23-	.00	37.76	7.30	.24-	.19
60	13	.5150	16.92	23.69	.04-	.50	30.26	6.19	.04-	.50	37.80	6.57	.20-	.54
60	14	.5775	16.84	23.96	.12-	.23	30.23	6.50	.07-	.19	37.92	7.00	.08-	.11
60	15	.6400	16.96	23.92	.00-	.27	30.30	6.46	.00-	.23	38.00	18.65	.00-	11.54-

TEST SUBJECT AME-3 C. BROOKS

		TEMPLE					EYE				NOSE			
TEST NO	PT NO	TIME	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY
61	0	.0000	18.6	32.90	.00-	.00	19.27	31.85	.00-	.00	21.13	30.69	.00-	.00
61	1	.0200	18.3	32.59	.35-	.31	19.16	31.39	.11-	.46	20.70	30.38	.43-	.31
61	2	.0400	18.1	31.70	.50-	1.20	19.39	30.30	.12	1.55	21.13	29.18	.00-	1.51
61	3	.0600	18.8	31.00	.16-	1.90	19.85	29.65	.58	2.20	21.44	28.45	.31	2.24
61	4	.0800	19.0	31.43	.31	1.47	19.89	29.84	.62	2.01	21.60	28.60	.47	2.09
	5	.1000	18.9	31.31	.27	1.59	19.81	30.03	.54	1.82	21.48	28.91	.35	1.78
61	6	.1200	19.0	31.50	.31	1.40	19.70	30.03	.43	1.82	21.40	28.95	.27	
61	7	.1400	18.6	31.35	.00-	1.55	19.62	30.03	.35	1.82	21.44	28.80	.31	1.89
61	8	.2025	18.8	31.81	.12	1.09	19.58	30.65	.31	1.20	21.32	29.38	.19	.31
61	9	.2650	18.6	32.32	.04-	.42-	19.27	32.32	.00-	.47-	21.36	31.31	.23	.62
61	10	.3275	18.8	32.94	.20	.04-	19.85	32.01	.58	.16-	21.21	30.73	.08	.04-
61	11	.3900	18.8	32.28	.16	.62	19.62	31.08	.35	.77	21.17	29.96	.04	.73
61	12	.4525	18.5	32.82	.19-	.08	19.43	31.58	.16	.27	21.05	30.65	.08-	.04
61	13	.5150	18.6	32.59	.04-	.31	19.31	31.50	.04	.35				
61	14	.5775	18.5	32.67	.15-	.23	19.43	31.27	.16	.58	21.29	30.46	.16	.23
61	15	.6400	18.6	32.63	.04-	.27	19.35	31.43	.08	.42	21.29	30.38	.16	.31

		SHOULDER					THIGH				KNEE			
TEST NO	PT NO	TIME	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY	X	Y	ΔX	ΔY
61	0	.0000	15.7	27.17	.00	.00	32.49	7.70	.00	.00	40.91	7.97	.00	.00
61	1	.0200	15.7	26.82	.00-	.35	32.28	7.16	.15-	.54	40.87	7.50	.04-	.47
61	2	.0400	15.7	25.54	.00-	1.63	32.51	7.04	.08	.66	40.95	7.08	.04	.89
61	3	.0600	15.9	24.61	.11	2.56	32.67	7.16	.24	.54	41.22	7.35	.31	.62
61	4	.0800	15.5	24.89	.27-	2.28	32.55	7.20	.12	.50	40.99	7.74	.08	.23
61	5	.1000	15.6	25.04	.16-	2.13	32.55	7.00	.12	.70	41.18	7.16	.27	.81
61	6	.1200	16.0	25.27	.23	1.90	32.67	6.96	.24	.74	41.14	7.27	.23	.70
61	7	.1400	16.1	25.04	.31	2.13	32.55	7.20	.12	.50	41.11	7.50	.20	.47
61	8	.2025	15.7	25.97	.04-	1.20	32.31	7.50	.08	.20	41.11	7.93	.20	.04
61	9	.2650	16.1	27.98	.31	.81-	32.09	8.51	.34-	.81-	40.37	9.44	.54-	1.47-
61	10	.3275	16.1	27.44	.39	.27-	32.36	7.47	.07-	.23	40.94	8.01	.04	.04-
61	11	.3900	15.8	26.74	.08	.43	32.28	8.12	.15-	.42-	40.60	8.82	.31-	.85-
61	12	.4525	15.9	27.13	.11	.04	32.32	8.05	.11-	.35-	40.68	8.47	.23-	.50-
61	13	.5150	16.1	26.98	.31	.19	32.51	7.43	.08	.27	41.07	7.54	.16	.43
61	14	.5775	16.1	26.98	.31	.19	32.40	7.78	.03-	.08-	40.95	8.16	.04	.19
61	15	.6400	16.2	26.94	.42	.23	32.55	7.47	.12	.23	41.14	7.58	.23	.39

TEST SUBJECT 95%ile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
61	0	.0000	19.5	31.58	.00-	.00	19.85	30.23	.00-	.00	21.17	28.60	.00-	.00
61	1	.0200	19.5	31.12	-.08	.46	20.16	29.88	-.31	.35	21.09	28.10	.08-	-.50
61	2	.0400	19.7	30.00	.24	1.58	20.16	28.76	.31	1.07	21.32	27.01	.15	1.59
61	3	.0600	20.1	29.69	.62	1.89	20.43	28.25	.58	1.98	21.17	26.28	.00	2.32
61	4	.0800	20.9	29.14	1.40	2.44	20.90	27.83	1.05	2.40	21.44	25.89	.27	2.71
61	5	.1000	21.2	29.10	1.75	2.48	21.25	27.69	1.40	2.60	21.63	25.66	.46	2.94
61	6	.1200	21.4	28.95	1.94	2.63	21.48	27.29	1.63	2.94	21.60	25.20	.43	3.40
61	7	.1400	21.0	28.60	1.55	2.98	21.01	27.17	1.16	3.06	21.60	25.16	.43	3.44
61	8	.2025	21.4	30.00	1.90	1.58	21.52	28.41	1.67	1.82	21.79	26.09	.62	2.52
61	9	.2650	21.6	30.42	2.13	1.16	21.79	29.07	1.94	1.16	22.41	27.40	1.24	1.20
61	10	.3275	21.5	29.69	2.02	1.89	21.83	28.14	1.98	2.09	21.94	25.89	.77	2.71
61	11	.3900	21.6	30.42	2.13	1.16	21.79	28.68	1.94	1.55	22.18	26.59	1.01	2.01
61	12	.4525	21.5	29.84	2.02	1.74	21.52	28.37	1.67	1.86	22.21	26.43	1.04	2.17
61	13	.5150	21.4	29.80	1.90	1.78	21.79	28.45	1.94	1.78	22.14	26.47	.97	2.13
61	14	.5775	21.7	29.53	2.29	2.05	21.67	28.33	1.82	1.90	22.18	26.47	1.01	2.13
61	15	.6400	21.7	29.96	2.29	1.62	21.87	28.21	2.02	2.02	22.10	26.43	.93	2.17

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
61	0	.0000	17.0	24.27	.00	.00	30.42	6.61	.00	.00	38.09	7.04	.00	.00
61	1	.0200	17.0	23.76	.00-	.51	30.50	6.11	.08	.50	38.01	6.54	.08-	.50
61	2	.0400	16.9	22.80	.16	1.47	30.65	5.72	.23	.89	38.16	6.38	.07	.66
61	3	.0600	16.4	22.83	.66-	1.44	30.54	5.92	.12	.69	37.93	6.81	.16-	.23
61	4	.0800	16.4	23.03	.66	1.24	30.38	6.00	.04-	.61	37.89	6.73	.20	.31
61	5	.1000	16.6	22.87	.39-	1.40	30.61	5.76	.19	.85	37.97	6.54	.12-	.50
61	6	.1200	16.6	22.95	.43	1.32	30.54	5.88	.12	.73	38.01	6.54	.08	.50
61	7	.1400	16.6	22.83	.43-	1.44	30.54	5.76	.12	.85	37.93	6.58	.16-	.46
61	8	.2025	16.6	24.11	.43-	.16	30.50	6.61	.08	.00	37.97	7.27	.12-	.23-
61	9	.2650	16.9	24.92	.16-	.65-	30.03	7.39	.39-	.78-	37.74	8.09	.35-	1.05-
61	10	.3275	16.7	23.76	.31-	.51	30.34	6.11	.08-	.50	38.01	6.85	.08	.19
61	11	.3900	16.8	24.23	.24-	.04	30.19	6.73	.23-	.12-	37.89	7.39	.20-	.35-
61	12	.4525	16.9	24.00	.16-	.27	30.34	6.34	.08-	.27	38.01	6.77	.08	.27
61	13	.5150	16.9	24.00	.08-	.27	30.30	6.34	.12-	.27	37.97	7.00	.12-	.04
61	14	.5775	17.0	23.96	.00-	.31	30.38	6.38	.04-	72.87	37.97	6.89	.12-	.15
61	15	.6400	16.9	24.00	.08-	.27	30.38	6.34	.04-	.27	38.12	6.85	.03	.19

TABLE III

TABULATED DISPLACEMENT DATA SHOWING BODY MOVEMENT OF

D. BRICE AND 50 PERCENTILE DUMMY

TEST SUBJECT- HM-2 D. BRICE

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
36	0	.0000	19.36	29.61	.00-	.00	19.51	29.01	.00-	.00	20.84	27.56	.00-	.00
36	1	.0200	19.48	29.43	.12	.38	19.63	28.36	.12	.65	20.96	27.19	.12	.37
36	2	.0400	19.51	28.82	.15	.99	19.74	28.10	.23	.91	20.96	26.65	.12	.91
36	3	.0600	19.74	29.67	.38	1.14	19.97	27.96	.46	1.03	21.11	26.62	.27	.94
36	4	.0800	19.82	28.72	.46	1.11	19.97	28.06	.46	.95	21.19	26.65	.35	.91
36	5	.1000	19.75	28.93	.42	.88	20.05	28.10	.54	.91	21.26	26.64	.42	.72
36	6	.1200	19.67	29.05	.31	.76	19.93	28.17	.42	.84	21.12	26.84	.31	.72
36	7	.1400	19.74	29.05	.38	.76	19.89	28.10	.38	.91	21.22	26.84	.38	.72
36	8	.2025	20.01	28.78	.65	1.03	20.31	27.87	.80	1.14	21.41	26.39	.57	1.17
36	9	.2650	19.97	28.59	.61	1.22	20.27	27.79	.76	1.22	21.30	26.39	.46	1.17
36	10	.3275	20.24	28.51	.88	1.30	20.46	27.56	.95	1.45	21.53	26.08	.69	1.48
36	11	.3900	20.46	28.67	1.10	1.14	20.62	27.68	1.11	1.33	21.68	26.27	.84	1.29
36	12	.4525	20.50	29.81	1.14	.00	20.73	28.89	1.22	.12	21.87	27.45	1.03	.11
36	13	.5150	20.27	29.65	.91	.16	20.50	28.78	.99	.23	21.56	27.11	.72	.45
36	14	.5775	20.01	29.58	.65	.23	20.16	28.74	.65	.27	21.45	27.19	.61	.37
36	15	.6400	19.70	30.19	.34	.38-	19.97	29.24	.46	.23-	21.30	27.72	.46	.16-

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
36	0	.0000	15.94	24.68	.00-	.00					39.94	6.37	.00-	.00
36	1	.0200	16.13	24.41	.19	.27					39.94	6.03	.00-	.34
36	2	.0400	15.83	23.88	.11-	.80					39.98	5.65	.04	.72
36	3	.0600	15.98	23.54	.04	1.14					40.02	5.65	.08	.72
36	4	.0800	15.75	23.73	.19-	.95					39.91	5.92	.03-	.45
36	5	.1000	15.75	23.88	.19-	.80					40.13	5.73	.19	.64
36	6	.1200	15.94	23.81	.00-	.87					48.83	5.46	.18	.91
36	7	.1400	16.36	23.77	.42	.91					40.10	5.43	.16	.94
36	8	.2025	16.51	23.43	.57	1.25					39.98	5.27	.04	1.10
36	9	.2650	16.40	23.27	.46	1.41					39.87	5.31	.07-	1.06
36	10	.3275	16.51	23.27	.57	1.41					39.91	5.20	.03-	1.17
36	11	.3900	16.40	23.01	.46	1.67					39.87	5.39	.07-	.98
36	12	.4525	16.48	24.26	.54	.42					39.87	6.49	.07-	.12-
36	13	.5150	16.29	24.07	.35	.61					39.64	6.37	.30-	.00
36	14	.5775	16.40	23.54	.46	1.14					39.98	5.39	.04	.98
36	15	.6400	15.83	23.88	.11-	.80					40.02	5.16	.08	1.21

TEST SUBJECT- 50% tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
36	0	.0000					19.74	28.74	.00-	.00	20.92	27.22	.00-	.00
36	1	.0200					19.86	28.48	.12	.26	21.03	26.77	.11	.45
36	2	.0400					19.78	28.17	.04	.57	20.96	26.54	.04	.68
36	3	.0600					19.97	27.49	.23	1.25	21.00	25.97	.08	1.25
36	4	.0800					20.12	27.26	.38	1.48	20.92	25.59	.00-	1.63
36	5	.1000					20.05	27.19	.31	1.55	20.92	25.48	.00-	1.74
36	6	.1200					20.05	27.15	.31	1.59	21.00	25.51	.08	1.71
36	7	.1400					20.16	27.15	.42	1.59	21.03	25.67	.11	1.55
36	8	.2025					19.97	27.30	.23	1.44	21.03	25.67	.11	1.55
36	9	.2650					20.20	27.22	.46	1.52	20.96	25.78	.04	1.44
36	10	.3275					20.16	27.11	.42	1.63	20.96	25.51	.04	1.71
36	11	.3900					19.93	27.79	.19	.95	20.92	26.24	.00-	.98
36	12	.4525					20.27	28.21	.53	.53	21.07	26.50	.15	.72
36	13	.5150					20.65	27.56	.91	1.18	21.37	25.97	.45	1.25
36	14	.5775					20.12	28.02	.38	.72	21.00	26.27	.08	.95
36	15	.6400					20.27	27.94	.53	.80	21.19	26.24	.27	.98

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
36	0	.0000	16.44	23.27	.00-	.00	30.72	5.69	.00-	.00	38.08	5.50	.00-	.00
36	1	.0200	16.51	22.74	.07	.53	30.56	5.39	.16-	.30	38.01	5.16	.07-	.34
36	2	.0400	16.44	22.29	.00-	.98	30.68	5.01	.04-	.68	38.16	4.86	.08	.64
36	3	.0600	16.32	21.91	.12-	1.36	30.83	5.05	.11	.64	38.12	5.05	.04	.45
36	4	.0800	15.98	21.98	.46-	1.29	30.68	5.31	.04-	.38	37.97	5.43	.11-	.07
36	5	.1000	16.02	21.94	.42-	1.33	30.68	5.24	.04-	.45	37.86	5.24	.22-	.26
36	6	.1200	16.02	21.94	.42-	1.33	30.60	5.16	.12-	.53	37.93	5.20	.15-	.30
36	7	.1400	16.10	22.02	.34-	1.25	30.60	5.27	.12-	.42	37.93	5.27	.15-	.23
36	8	.2025	16.17	22.21	.27-	1.06	30.68	5.27	.04-	.42	38.12	5.27	.04	.23
36	9	.2650	16.06	22.10	.38-	1.17	30.75	5.27	.03	.42	37.97	5.27	.11-	.23
36	10	.3275	16.10	21.87	.34-	1.40	30.60	5.08	.12-	.61	38.01	5.16	.07-	.34
36	11	.3900	16.10	22.78	.34-	.49	30.56	5.73	.16-	.04-	37.86	5.73	.22-	.23-
36	12	.4525	16.21	23.39	.23-	.12-	30.68	6.00	.04-	.31-	38.01	5.65	.07-	.15-
36	13	.5150	16.36	22.51	.08-	.76	30.64	5.31	.08-	.38	38.16	5.24	.08	.26
36	14	.5775	16.10	22.97	.34-	.30	30.72	5.69	.00-	.00	37.97	5.58	.11-	.08-
36	15	.6400	16.25	22.78	.19-	.49	30.87	5.46	.15	.23	38.08	5.16	.00-	.34

TEST SUBJECT- HM-2 D. BRI

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
37	0	.0000	18.87	30.83	.00-	.00	19.51	29.16	.00-	.00	20.46	27.94	.00-	.00
37	1	.0200	19.17	30.34	.30	.49	19.48	28.62	.03-	.34	20.65	27.26	.19	.68
37	2	.0400	19.16	29.58	.2.	1.25	19.63	28.06	.12	1.10	20.73	26.62	.27	1.32
37	3	.0600	19.44	29.43	.57	1.40	19.67	27.94	.16	1.22	20.77	26.35	.31	1.59
37	4	.0800	19.51	29.35	.64	1.46	19.78	28.02	.27	1.14	20.88	26.46	.42	1.48
37	5	.1000	19.48	29.62	.61	1.21	19.86	28.17	.35	.99	20.88	26.46	.42	1.48
37	6	.1200	19.48	29.77	.61	1.06	19.78	28.29	.27	.87	20.92	26.73	.46	1.21
37	7	.1400	19.55	29.62	.68	1.21	19.86	28.13	.35	1.03	20.92	26.54	.46	1.40
37	8	.2025	19.82	29.31	.95	1.52	20.08	27.87	.57	1.29	21.15	26.20	.69	1.74
37	9	.2650	19.93	29.50	1.06	1.33	20.16	28.10	.65	1.06	21.07	26.35	.61	1.59
37	10	.3275	19.51	30.56	.64	.27	19.78	29.39	.27	.23-	20.77	27.91	.31	.03
37	11	.3900	19.17	30.72	.30	.11	19.59	29.39	.08	.23-	20.73	27.91	.27	.03
37	12	.4525	19.25	30.07	.38	.76	19.55	28.82	.04	.34	20.58	27.41	.12	.53
37	13	.5150	19.25	30.79	.38	.04	19.55	29.43	.04	.27-	20.77	27.79	.31	.15
37	14	.5775	19.17	30.87	.30	.04-	19.59	29.31	.08	.15-	20.69	27.79	.23	.15
37	15	.6400	19.17	30.83	.30	.00	19.40	29.35	.11-	.19-	20.69	27.91	.23	.03

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
37	0	.0000	16.06	24.37	.00-	.00	25.70	4.70	.00-	.00	39.38	5.43	.00-	.00
37	1	.0200	16.10	23.88	.04	.49	25.70	4.02	.00-	.68	39.38	4.78	.00-	.65
37	2	.0400	16.13	23.05	.07	1.32	25.89	3.91	.19	.79	39.60	4.70	.22	.73
37	3	.0600	15.83	22.67	.23-	1.70	26.08	4.13	.38	.57	39.72	5.08	.34	.35
37	4	.0800	15.72	22.82	.34-	1.55	26.01	3.94	.31	.76	39.68	4.74	.30	.69
37	5	.1000	15.83	22.82	.23-	1.55	26.01	3.98	.31	.72	39.72	4.63	.34	.80
37	6	.1200	15.83	22.89	.23-	1.48	26.01	4.02	.31	.68	39.79	4.70	.41	.73
37	7	.1400	16.10	22.67	.04	1.70	26.01	4.10	.31	.60	39.72	4.70	.34	.73
37	8	.2025	16.25	22.25	.19	2.12	26.08	4.10	.38	.60	39.72	4.63	.34	.80
37	9	.2650	16.36	22.59	.30	1.78	26.05	4.29	.35	.41	39.75	4.97	.37	.46
37	10	.3275	16.29	24.15	.23	.22	25.70	4.86	.00-	.16-	39.34	5.96	.04-	.53-
37	11	.3900	16.29	23.88	.23	.49	25.48	4.82	.22-	.12-	39.22	5.84	.16-	.41-
37	12	.4525	16.10	22.78	.04	1.59	25.97	4.63	.27	.07	39.79	4.63	.41	.80
37	13	.5150	16.10	23.35	.04	1.02	25.93	4.63	.23	.07	39.45	5.27	.07	.16
37	14	.5775	16.21	23.39	.15	.98	25.97	4.51	.27	.19	39.75	4.89	.37	.54
37	15	.6400	16.02	23.35	.04-	1.02	25.82	4.67	.12	.03	39.56	5.12	.18	.31

TEST SUBJECT- 50% tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
37	0	.0000					19.93	27.87	.00-	.00	21.11	26.46	.00-	.00
37	1	.0200					20.08	27.34	.15	.53	20.92	25.86	.19-	.60
37	2	.0400					19.93	26.77	.00-	1.10	20.88	25.21	.23-	1.25
37	3	.0600					20.01	25.82	.08	2.05	20.88	24.45	.23-	2.01
37	4	.0800					20.50	25.17	.57	2.70	21.00	24.00	.11-	2.45
37	5	.1000					20.43	25.40	.50	2.47	20.81	24.11	.30-	2.35
37	6	.1200					21.07	25.48	1.14	2.39	21.19	23.50	.08	2.96
37	7	.1400					21.26	25.32	1.33	2.55	21.34	23.24	.23	3.22
37	8	.2025												
37	9	.2650												
37	10	.3275												
37	11	.3900												
37	12	.4525												
37	13	.5150												
37	14	.5775												
37	15	.6400												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
37	0	.0000	16.17	22.89	.00-	.00					37.74	5.46	.00-	.00
37	1	.0200	16.29	22.51	.12	.38					37.82	4.89	.08	.57
37	2	.0400	16.13	21.64	.04-	1.25					37.78	4.67	.04	.79
37	3	.0600	15.75	21.26	.42-	1.63					37.78	5.31	.04	.15
37	4	.0800	15.60	21.49	.57-	1.40					37.63	5.58	.11-	.12-
37	5	.1000	15.68	21.60	.49-	1.29					37.59	5.69	.15-	.23-
37	6	.1200	15.87	21.53	.30-	1.36					37.63	5.24	.11-	.22
37	7	.1400	16.06	21.41	.11-	1.48					37.74	5.08	.00-	.38
37	8	.2025	15.94	21.53	.23-	1.36					37.63	5.31	.11-	.15
37	9	.2650	15.87	21.94	.30-	.95					37.74	5.46	.00-	.00
37	10	.3275	16.06	23.62	.11-	.73-					37.59	6.03	.15-	.57-
37	11	.3900	15.98	23.46	.19-	.57-					37.25	5.35	.49-	.11
37	12	.4525	16.02	23.46	.15-	.57-					37.29	5.27	.45-	.19
37	13	.5150	16.10	22.55	.07-	.34					37.63	5.31	.11-	.15
37	14	.5775	16.10	23.05	.07-	.16-					37.55	5.20	.19-	.26
37	15	.6400	16.13	22.93	.04-	.04-					37.59	5.08	.15-	.38

TEST SUBJECT HM-2 D. BRICE

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
45	0	.0000									20.58	27.87	.00-	.00
45	1	.0200									20.69	27.37	.11	.50
45	2	.0400									20.69	26.58	.11	1.29
45	3	.0600									20.81	25.70	.23	2.17
45	4	.0800									21.00	25.63	.42	2.24
45	5	.1000									21.19	25.97	.61	1.90
45	6	.1200									21.68	25.74	1.10	2.13
45	7	.1400									21.68	25.89	1.10	1.98
45	8	.2025									22.06	26.73	1.48	1.14
45	9	.2650									21.68	27.83	1.10	.04
45	10	.3275									21.00	27.07	.42	.80
45	11	.3900									21.00	26.92	.42	.95
45	12	.4525									21.34	27.75	.76	.12
45	13	.5150									21.26	27.68	.68	.19
45	14	.5775									21.19	27.53	.61	.34
45	15	.6400									20.84	28.29	.26	.42-

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
45	0	.0000	15.94	24.03	.00-	.00	32.96	4.32	.00-	.00	39.26	4.97	.00-	.00
45	1	.0200	15.91	23.69	.03-	.34	33.07	4.06	.11	.26	39.30	4.67	.04	.30
45	2	.0400	15.91	22.59	.03-	1.44	33.15	4.06	.19	.26	39.49	4.06	.23	.91
45	3	.0600	16.06	21.72	.12	2.31	33.34	4.06	.38	.26	39.75	4.29	.49	.68
45	4	.0800	16.13	21.45	.19	2.58	33.38	4.10	.42	.22	39.83	4.40	.57	.57
45	5	.1000	16.13	21.79	.19	2.24	33.34	4.06	.38	.26	39.83	4.36	.57	.61
45	6	.1200	16.36	21.49	.42	2.54	33.34	3.91	.38	.41	39.79	4.13	.53	.84
45	7	.1400	16.67	21.26	.73	2.77	33.34	4.13	.38	.19	39.83	4.40	.57	.57
45	8	.2025	16.48	23.43	.54	.60	33.03	4.70	.07	.38-	39.26	5.46	.00-	.49-
45	9	.2650	16.82	24.75	.88	.72-	31.89	5.16	1.07-	.84-	38.54	6.26	.72-	1.29-
45	10	.3275	16.29	23.24	.35	.79	32.39	4.32	.57-	.00	39.11	4.86	.15-	.11
45	11	.3900	16.13	22.93	.19	1.10	32.92	4.48	.04-	.16-	39.38	4.63	.12	.34
45	12	.4525	16.40	23.54	.46	.49	32.69	4.70	.27-	.38-	39.00	4.67	.26-	.30
45	13	.5150	16.44	23.31	.50	.72	32.73	4.36	.23-	.04-	39.15	4.40	.11-	.57
45	14	.5775	16.21	23.20	.27	.83	32.81	4.48	.15-	.16-	39.30	4.67	.04	.30
45	15	.6400	16.02	23.58	.08	.45	32.77	4.74	.19-	.42-	39.22	4.82	.04-	.15

TEST SUBJECT - 50% tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
45	0	.0000												
45	1	.0200												
45	2	.0400												
45	3	.0600												
45	4	.0800												
45	5	.1000												
45	6	.1200												
45	7	.1400												
45	8	.2025												
45	9	.2650												
45	10	.3275												
45	11	.3900												
45	12	.4525												
45	13	.5150												
45	14	.5775												
45	15	.6400												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
45	0	.0000	16.63	22.86	.00-	.00	31.10	5.43	.00-	.00	37.63	5.54	.00-	.00
45	1	.0200	16.63	22.32	.00-	.54	31.10	5.08	.00-	.35	37.55	5.12	.08-	.42
45	2	.0400	16.32	21.22	.31-	1.64	31.13	4.70	.03	.73	37.51	4.82	.12-	.72
45	3	.0600	15.94	21.00	.69-	1.86	30.98	4.86	.12-	.57	37.44	5.54	.19-	.00
45	4	.0800	15.91	21.34	.72-	1.52	30.94	5.08	.16-	.35	37.29	5.62	.34-	.08-
45	5	.1000	16.06	21.15	.57-	1.71	30.94	4.86	.16-	.57	37.32	5.12	.31-	.42
45	6	.1200	16.29	20.92	.34-	1.94	31.13	4.63	.03	.80	37.48	5.05	.15-	.49
45	7	.1400	16.25	21.22	.38-	1.64	31.02	4.78	.08-	.65	37.51	5.31	.12-	.23
45	8	.2025	16.40	23.39	.23-	.53-	31.10	6.18	.00-	.75-	37.67	6.26	.04	.72-
45	9	.2650	16.48	23.69	.15-	.83-	30.56	6.07	.54-	.64-	37.17	6.26	.46-	.72-
45	10	.3275	16.25	22.21	.38-	.65	30.98	4.89	.12-	.54	37.63	4.97	.00-	.57
45	11	.3900	16.36	22.93	.27-	.07-	30.75	5.58	.35-	.15-	37.32	5.69	.31-	.15-
45	12	.4525	16.55	22.63	.08-	.23	31.02	5.24	.08-	.19	37.59	5.20	.04-	.34
45	13	.5150	16.51	22.63	.12-	.23	30.98	5.12	.12-	.31	37.59	5.27	.04-	.27
45	14	.5775	16.36	22.70	.27-	.16	30.91	5.39	.19-	.04	37.55	5.46	.08-	.08
45	15	.6400	16.44	22.55	.19-	.31	30.94	5.27	.16-	.16	37.51	5.27	.12-	.27

TEST SUBJECT HM-2 D. BRICE

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
46		[illegible]	19.13	30.45	.00-	.00					20.81	27.75	.00-	.00
46	1	[illegible]	19.13	29.92	.00-	.53					20.81	27.37	.00-	.38
46	2	[illegible]	19.25	28.82	.12	1.63					20.62	26.31	.19-	1.44
46	3	[illegible]	19.55	28.21	.42	2.24					20.81	25.91	.00-	2.21
46	4	[illegible]	19.89	28.36	.76	2.09					21.19	25.48	.38	2.21
46	5	[illegible]	19.86	28.48	.73	1.97					21.15	25.86	.34	1.84
46	6	[illegible]	20.24	28.36	1.11	2.09					21.45	25.70	.64	2.05
46	7	[illegible]	20.65	28.17	1.52	2.28					21.79	25.59	.98	2.16
46	8	[illegible]	21.26	29.50	2.13	.95					22.29	26.81	1.48	.94
46	9	[illegible]	20.84	30.45	1.71	.00					22.17	27.87	1.36	.12-
46	10	[illegible]	19.17	30.34	.04	.11					20.77	27.68	.04-	.07
46	11	[illegible]	19.48	29.96	.35	.49					21.03	27.41	.22	.34
46	12	[illegible]	19.59	30.26	.46	.19					21.15	27.75	.34	.00
46	13	[illegible]	19.40	30.30	.27	.15					20.96	27.68	.15	.07
46	14	[illegible]	18.02	30.49	.11-	.04-					20.69	28.02	.12-	.27-
46	15	[illegible]	19.02	30.60	.11-	.15-					20.81	28.02	.00-	.27-

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
46	0	[illegible]	16.32	24.30	.00-	.00	33.15	5.43	.00-	.00	39.38	5.77	.00-	.00
46	1	[illegible]	16.21	23.92	.11-	.38	33.26	5.16	.11	.27	39.45	5.58	.07	.19
46	2	[illegible]	16.17	22.82	.15-	1.48	33.34	5.01	.19	.42	39.75	4.59	.37	1.18
46	3	[illegible]	15.87	21.79	.45-	2.51	33.75	4.89	.60	.54	39.98	4.74	.60	1.03
46	4	[illegible]	15.94	22.10	.38-	2.20	33.75	4.86	.60	.57	39.91	4.93	.53	.84
46	5	[illegible]	15.91	22.32	.41-	1.98	33.75	4.97	.60	.46	39.94	5.05	.56	.72
46	6	[illegible]	16.29	22.40	.03-	1.90	33.38	5.12	.23	.31	39.79	4.89	.41	.88
46	7	[illegible]	16.48	22.02	.16	2.28	33.60	4.82	.45	.61	39.94	4.51	.56	1.26
46	8	[illegible]	16.51	24.49	.19	.19-	33.03	6.07	.12-	.64-	39.19	6.91	.19-	1.14-
46	9	[illegible]	17.08	24.94	.76	.64-	31.82	6.64	1.33-	1.21-	38.43	7.32	.95-	1.55-
46	10	[illegible]	16.32	24.00	.00-	.30	32.65	5.62	.50-	.19-	39.07	5.96	.31-	.19-
46	11	[illegible]	16.29	23.58	.03-	.72	33.22	5.46	.07	.03-	39.56	5.20	.18	.57
46	12	[illegible]	16.48	23.92	.16	.38	32.58	5.77	.57-	.34-	39.07	5.39	.31-	.38
46	13	[illegible]	16.32	23.88	.00-	.42	33.03	5.35	.12-	.08	39.38	5.24	.00-	.53
46	14	[illegible]	16.02	23.77	.30-	.53	33.03	5.58	.12-	.15-	39.45	5.43	.07	.34
46	15	[illegible]	16.17	23.81	.15-	.49	32.96	5.62	.19-	.19-	39.30	5.08	.08-	.69

TEST SUBJECT 50% tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
46	0	.0000												
46	1	.0200												
46	2	.0400												
46	3	.0600												
46	4	.0800												
46	5	.1000												
46	6	.1200												
46	7	.1400												
46	8	.2025												
46	9	.2650												
46	10	.3275												
46	11	.3900												
46	12	.4525												
46	13	.5150												
46	14	.5775												
46	15	.6400												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
46	0	.0000	16.32	22.86	.00-	.00	30.79	5.43	.00-	.00	37.36	5.27	.00-	.00
46	1	.0200	16.40	21.91	.08	.95	30.83	4.70	.04	.73	37.29	4.70	.07-	.57
46	2	.0400	15.91	20.69	.41-	2.17	30.83	4.36	.04	1.07	37.17	4.70	.19-	.57
46	3	.0600	15.64	20.73	.68-	2.13	30.79	4.70	.00-	.73	37.17	5.35	.19-	.08-
46	4	.0800	15.64	21.00	.68-	1.86	30.60	4.82	.19-	.61	37.13	5.31	.23-	.04-
46	5	.1000	16.10	20.84	.22-	2.02	30.75	4.63	.04-	.80	37.21	5.01	.15-	.26
46	6	.1200	16.06	20.84	.26-	2.02	30.68	4.63	.11-	.80	37.06	5.01	.30-	.26
46	7	.1400	15.98	21.64	.34-	1.22	30.64	5.20	.15-	.23	37.13	5.84	.23-	.57-
46	8	.2025	16.10	24.22	.22-	1.36-	30.53	6.91	.26-	1.48-	37.06	7.13	.30-	1.86-
46	9	.2650	15.79	23.46	.53-	.60-	30.22	6.30	.57-	.87-	36.83	6.60	.53-	1.33-
46	10	.3275	15.98	22.10	.34-	.76	30.98	4.89	.19	.54	37.48	4.97	.12	.30
46	11	.3900	16.10	22.89	.22-	.03-	30.64	5.81	.15-	.38-	37.17	6.00	.19-	.73-
46	12	.4525	16.40	22.48	.08	.38	30.87	5.31	.08	.12	37.44	5.24	.08	.03
46	13	.5150	16.21	22.44	.11-	.42	30.83	5.35	.04	.08	37.32	5.39	.04-	.12-
46	14	.5775	16.25	22.51	.07-	.35	30.87	5.27	.08	.16	37.48	5.27	.12	.00
46	15	.6400	16.10	22.40	.22-	.46	30.83	5.31	.04	.12	37.40	5.27	.04	.00

TABLE IV

TABULATED DISPLACEMENT DATA SHOWING BODY MOVEMENT OF

L. REED AND 5 PERCENTILE DUMMY

TWOOT_ANH-2 L. REED

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	CYR X	CYR Y	CYR ΔX	CYR ΔY	[illegible] X	[illegible] Y	[illegible] ΔX	[illegible] ΔY
41	0	.0000					19.67	25.47	.00-	.00	21.34	27.63	.00-	.00
41	1	.0250					19.74	25.[illegible]	.09	.42	21.00	27.41	.16	.42
41	2	.0[illegible]0					19.59	25.[illegible]	.06-	.71	21.[illegible]	27.00	.06	.83
41	3	.[illegible]6.0					19.70	27.77	.04	1.18	21.11	26.77	.27	1.06
41	4	.[illegible]80					19.87	27.87	.22	1.10	21.22	26.76	.38	.87
41	5	.1000					19.70	28.[illegible]	.03	.91	21.15	26.96	.31	.87
41	6	.1250					19.55	26.25	.12-	.72	21.03	27.19	.19	.64
41	7	.1400					19.59	25.29	.08-	.68	21.07	27.11	.23	.72
41	8	.2025					19.74	27.96	.07	.99	20.54	27.07	.30-	.76
41	9	.2650												
41	10	.3275												
41	11	.3900												
41	12	.4525												
41	13	.5150												
41	14	.5775												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
41	0	.0000	15.94	24.22	.00-	.00	25.78	4.32	.00-	.00	39.30	5.73	.00-	.00
41	1	.0250	15.87	23.96	.07-	.26	25.78	3.94	.00-	.38	39.30	5.24	.00-	.49
41	2	.0450	15.79	23.43	.15-	.72	25.86	3.49	.08	.83	39.41	5.01	.11	.72
41	3	.0600	15.94	23.01	.00-	1.21	26.12	3.56	.34	.76	39.72	4.93	.42	.80
41	4	.0[illegible]0	15.98	23.16	.04	1.06	25.82	3.37	.04	.95	39.69	5.12	.19	.61
41	5	.1000	15.94	23.01	.00-	1.21	26.08	3.56	.30	.76	39.49	5.12	.19	.61
41	6	.1250	15.87	23.12	.07-	1.10	25.82	3.45	.04	.87	39.38	4.89	.08	.84
41	7	.1400	15.91	22.53	.03-	1.29	25.97	3.66	.17	.72	39.34	4.93	.04	.80
41	8	.2025	16.13	22.29	.19	1.53	26.05	3.41	.27	.91	39.45	5.05	.15	.68
41	9	.2650	16.36	22.10	.42	2.12	26.01	3.07	.23	1.25	39.60	5.08	.30	.65
41	10	.3275	16.78	21.72	.84	2.50	25.97	3.15	.17	1.17	39.60	5.05	.22	.68
41	11	.3900	16.84	21.91	.92	2.31	25.97	3.71	.17	.57	39.41	5.67	.11	.04
41	12	.4525	17.05	23.16	1.11	1.06	25.74	4.11	.04-	.19-	39.11	6.69	.19-	.98-
41	13	.5150	16.93	22.82	.99	1.40	25.70	4.[illegible]	.08-	.26	39.22	5.84	.06-	.11-
41	14	.5775	16.97	23.21	1.03	2.01	25.93	2.87	.15	.45	39.56	5.69	.26	.04

SUBJECT- SID. DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
41	0	.0000	2 .35	28.06	.00-	.00	21.00	26.46	.00-	.00	21.72	24.91	.00-	.00
41	1	.0200	20.35	27.49	.00-	.57								
41	2	.0400												
41	3	.0600												
41	4	.0800												
41	5	.1000												
41	6	.1200												
41	7	.1400												
41	8	.2025												
41	9	.2650												
41	10	.3275												
41	11	.3900												
41	12	.4525												
41	13	.5150												
41	14	.5775												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
41	0	.0000	17.24	19.13	.00-	.00					36.87	5.81	.00-	.00
41	1	.0200	17.27	18.87	.03	.26					36.79	5.27	.08-	.54
41	2	.0400	17.35	18.00	.11	1.13					36.94	4.82	.07	.99
41	3	.0600	17.31	18.03	.07	1.10					36.91	4.89	.04	92
41	4	.0800	17.27	17.69	.03	1.44					36.87	5.12	.00-	.69
41	5	.1000	17.08	17.77	.16-	1.36					36.87	5.08	.00-	.73
41	6	.1200	17.05	17.62	.19-	1.51					36.83	4.89	.04-	.92
41	7	.1400	17.08	17.88	.16-	1.25					36.79	5.08	.08-	.73
41	8	.2025	17.27	17.77	.03	1.36					36.75	5.08	.12-	.73
41	9	.2650	17.24	17.81	.00-	1.32					36.72	5.12	.15-	.69
41	10	.3275	17.16	17.77	.08-	1.36					36.79	5.12	.08-	.69
41	11	.3900	17.24	18.11	.00-	1.02					36.87	5.31	.00-	.50
41	12	.4525	17.12	19.25	.12-	.12-					36.75	5.69	.12-	.12
41	13	.5150	17.35	18.94	.11	.19					36.94	5.12	.07	.69
41	14	.5775	17.27	18.53	.03	.60					36.72	5.46	.15-	.35

SUBJECT , AMH-2 L. REED

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
42	0	.0000									20.77	27.60	.00-	.00
42	1	.0200									20.85	27.00	.11	.60
42	2	.0400									20.77	26.12	.00-	1.48
42	3	.0600									21.00	25.67	.23	1.93
42	4	.0800									21.37	25.89	.60	1.71
42	5	.1000									21.30	26.00	.53	1.82
42	6	.1200									21.15	26.31	.38	1.29
42	7	.1400									21.07	26.50	.30	1.10
42	8	.2025									21.19	26.08	.42	1.52
42	9	.2650									21.11	27.11	.34	.49
42	10	.3275									21.26	28.21	.49	.61-
42	11	.3900									20.88	27.56	.11	.04
42	12	.4525									21.11	26.39	.34	1.21
42	13	.5150									21.34	27.07	.57	.53
42	14	.5775									20.96	27.15	.19	.45

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
42	0	.0000	14.77	23.96	.00-	.00	33.11	5.24	.00-	.00	38.92	5.96	.00-	.00
42	1	.0200	14.73	23.46	.04-	.50	33.19	4.78	.08	.46	39.03	5.58	.11	.38
42	2	.0400	14.84	22.63	.07	1.33	33.22	4.55	.11	.69	39.26	4.97	.34	.99
42	3	.0600	15.03	21.87	.26	2.09	33.41	4.74	.30	.50	39.53	5.08	.61	.88
42	4	.0800	15.26	21.60	.49	2.36	33.49	4.82	.38	.42	39.56	5.46	.64	.50
42	5	.1000	15.49	21.64	.72	2.32	33.53	4.82	.42	.42	39.49	5.54	.57	.42
42	6	.1200	15.53	21.68	.76	2.28	33.38	4.89	.27	.35	39.41	5.39	.49	.57
42	7	.1400	15.49	21.37	.72	2.59	33.45	4.67	.34	.57	39.53	5.16	.61	.80
42	8	.2025	15.87	21.22	1.10	2.74	33.34	4.78	.23	.46	39.41	5.27	.49	.69
42	9	.2650	15.79	22.02	1.02	1.94	33.30	5.16	.19	.08	39.30	6.03	.38	.07
42	10	.3275	15.91	23.69	1.14	.27	32.84	6.22	.27-	.98-	38.58	7.29	.34-	1.33
42	11	.3900	15.94	23.35	1.17	.61	32.65	5.88	.46-	.64-	38.58	6.68	.34-	.72
42	12	.4525	15.91	22.06	1.14	1.90	33.07	5.01	.04-	.23	39.38	5.43	.46	.53
42	13	.5150	16.32	22.44	1.55	1.52	33.11	5.20	.00-	.04	39.22	6.11	.30	.15
42	14	.5775	16.06	22.63	1.29	1.33	32.96	5.27	.15-	.03-	39.11	5.96	.19	.00

SUBJECT 5%tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE □X	TEMPLE □Y	EYE X	EYE Y	EYE □X	EYE □Y	NOSE X	NOSE Y	NOSE □X	NOSE □Y
42	0	.0000												
42	1	.0200												
42	2	.0400												
42	3	.0600												
42	4	.0800												
42	5	.1000												
42	6	.1200												
42	7	.1400												
42	8	.2025												
42	9	.2650												
42	10	.3275												
42	11	.3900												
42	12	.4525												
42	13	.5150												
42	14	.5775												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER □X	SHOULDER □Y	THIGH X	THIGH Y	THIGH □X	THIGH □Y	KNEE X	KNEE Y	KNEE □X	KNEE □Y
42	0	.0000	18.22	19.59	.00-	.00	30.22	5.46	.00-	.00	36.15	5.39	.00-	.00
42	1	.0200	18.26	19.10	.04	.49	30.26	4.97	.04	.49	36.22	4.97	.07	.42
42	2	.0400	18.30	18.07	.08	1.52	30.45	4.86	.23	.60	36.34	5.01	.19	.38
42	3	.0600	18.11	18.11	.11-	1.48	30.41	4.86	.19	.60	36.26	4.97	.11	.42
42	4	.0800	17.88	18.26	.34-	1.33	30.26	4.86	.04	.60	36.19	5.01	.04	.38
42	5	.1000	18.07	18.07	.15-	1.52	30.38	4.82	.16	.64	36.15	4.93	.00-	.46
42	6	.1200	18.07	18.22	.15-	1.37	30.38	4.89	.16	.57	36.19	5.01	.04	.38
42	7	.1400	18.00	18.19	.22-	1.40	30.38	4.86	.16	.60	36.19	4.93	.04	.46
42	8	.2025	18.00	18.11	.22-	1.48	30.38	4.82	.16	.64	36.26	4.93	.11	.46
42	9	.2650	18.07	18.94	.15-	.65	30.30	5.27	.08	.19	36.07	5.24	.08-	.15
42	10	.3275	18.03	19.74	.19-	.15-	29.96	5.43	.26-	.03	35.84	5.31	.31-	.08
42	11	.3900	18.00	19.10	.22-	.49	30.19	5.01	.03-	.45	35.92	5.20	.23-	.19
42	12	.4525	18.19	19.10	.03-	.49	30.15	5.35	.07-	.11	35.92	5.39	.23-	.00
42	13	.5150	18.03	19.02	.19-	.57	30.15	5.20	.07-	.26	36.00	5.27	.15-	.12
42	14	.5775	18.15	19.06	.07-	.53	30.22	5.27	.00-	.19	36.11	5.39	.04-	.00

SUBJECT ANH-2 L. REED

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE □X	TEMPLE □Y	EYE X	EYE Y	EYE □X	EYE □Y	NOSE X	NOSE Y	NOSE □X	NOSE □Y
43	0	.0000												
43	1	.0200												
43	2	.0400												
43	3	.0600												
43	4	.0800												
43	5	.1000												
43	6	.1200												
43	7	.1400												
43	8	.2025												
43	9	.2650												
43	10	.3275												
43	11	.3900												
43	12	.4525												
43	13	.5150												
43	14	.5775												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER □X	SHOULDER □Y	THIGH X	THIGH Y	THIGH □X	THIGH □Y	KNEE X	KNEE Y	KNEE □X	KNEE □Y
43	0	.0000	15.41	23.46	.00-	.00	33.45	5.01	.00-	.00	38.88	5.54	.00-	.00
43	1	.0200	15.37	22.97	.04-	.49	33.26	4.44	.19-	.57	38.84	5.16	.04-	.38
43	2	.0400	15.45	21.49	.04	1.97	33.38	4.06	.07-	.95	39.34	4.17	.46	1.37
43	3	.0600	15.87	20.05	.46	3.41	33.72	3.91	.27	1.10	39.60	3.91	.72	1.63
43	4	.0800	16.48	19.78	1.07	3.68	33.72	4.06	.27	.95	39.56	4.29	.68	1.25
43	5	.1000	16.86	20.12	1.45	3.34	33.75	4.06	.30	.95	39.60	4.17	.72	1.37
43	6	.1200	17.01	20.16	1.60	3.30	33.67	4.06	.42	.95	40.21	4.44	1.33	1.10
43	7	.1400	16.93	19.93	1.52	3.53	33.75	4.13	.30	.88	39.91	4.29	1.03	1.25
43	8	.2025	16.67	22.78	1.26	.68	33.49	5.05	.04	.04-	39.26	6.22	.38	.68-
43	9	.2650	16.59	24.37	1.18	.91-	32.50	6.41	.95-	1.40-	38.35	7.36	.53-	1.82-
43	10	.3275	16.67	22.89	1.26	.57	33.03	4.82	.42-	.19	39.07	5.50	.19	.04
43	11	.3900	16.74	22.51	1.33	.95	33.22	4.97	.23-	.04	39.19	5.46	.31	.08
43	12	.4525	16.89	22.82	1.48	.64	33.30	5.31	.15-	.30-	39.26	5.73	.38	.19-
43	13	.5150	16.74	22.67	1.33	.79	33.30	4.67	.15-	.34	39.22	4.86	.34	.68
43	14	.5775	16.67	22.44	1.26	1.02	33.22	4.74	.23-	.27	39.22	5.01	.34	.53

TEST SUBJECT 5%tile DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE ΔX	TEMPLE ΔY	EYE X	EYE Y	EYE ΔX	EYE ΔY	NOSE X	NOSE Y	NOSE ΔX	NOSE ΔY
43	0	.0000												
43	1	.0200												
43	2	.0400												
43	3	.0600												
43	4	.0800												
43	5	.1000												
43	6	.1200												
43	7	.1400												
43	8	.2025												
43	9	.2650												
43	10	.3275												
43	11	.3900												
43	12	.4525												
43	13	.5150												
43	14	.5775												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER ΔX	SHOULDER ΔY	THIGH X	THIGH Y	THIGH ΔX	THIGH ΔY	KNEE X	KNEE Y	KNEE ΔX	KNEE ΔY
43	0	.0000	18.34	19.06	.00-	.00	30.38	4.97	.00-	.00	36.22	4.97	.00-	.00
43	1	.0200	18.34	18.22	.00-	.84	30.34	4.55	.04-	.42	36.26	4.55	.04	.42
43	2	.0400	18.30	17.46	.04-	1.60	30.45	4.32	.07	.65	36.26	4.40	.04	.57
43	3	.0600	18.15	18.11	.19-	.95	30.41	4.82	.03	.15	36.30	4.82	.08	.15
43	4	.0800	18.15	18.19	.19-	.87	30.41	4.82	.03	.15	36.30	4.86	.08	.11
43	5	.1000	18.07	18.00	.27-	1.06	30.38	4.89	.00-	.08	36.26	4.89	.04	.08
43	6	.1200	18.07	18.00	.27-	1.06	30.38	4.70	.00-	.27	36.22	4.86	.00-	.11
43	7	.1400	18.07	17.96	.27-	1.10	30.45	4.74	.07	.23	36.26	4.78	.04	.19
43	8	.2025	18.30	19.67	.04-	.61-	30.15	5.50	.23-	.53-	36.03	5.65	.19-	.69-
43	9	.2650	18.22	19.82	.12-	.76-	30.07	5.50	.31-	.53-	35.96	5.46	.26-	.49-
43	10	.3275	18.07	18.91	.27-	.15	30.45	5.05	.07	.08-	36.30	5.27	.08	.30-
43	11	.3900	18.11	19.06	.23-	.00	30.26	5.12	.12-	.15-	36.15	5.31	.07-	.04-
43	12	.4525	18.15	18.87	.19-	.19	30.38	4.97	.00-	.00	36.26	5.05	.04	.08-
43	13	.5150	18.15	18.98	.19-	.08	30.30	5.16	.08-	.19-	36.11	5.12	.11-	.15-
43	14	.5775	18.11	18.94	.23-	.12	30.38	5.12	.00-	.15-	36.19	5.12	.03-	.15-

SUBJECT AMH-2 L. REED

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE □X	TEMPLE □Y	EYE X	EYE Y	EYE □X	EYE □Y	NOSE X	NOSE Y	NOSE □X	NOSE □Y
44	0	.0000												
44	1	.0200												
44	2	.0400												
44	3	.0600												
44	4	.0800												
44	5	.1000												
44	6	.1200												
44	7	.1400												
44	8	.2025												
44	9	.2650												
44	10	.3275												
44	11	.3900												
44	12	.4525												
44	13	.5150												
44	14	.5775												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER □X	SHOULDER □Y	THIGH X	THIGH Y	THIGH □X	THIGH □Y	KNEE X	KNEE Y	KNEE □X	KNEE □Y
44	0	.0000	15.56	23.50	.00-	.00	33.45	5.12	.00-	.00	38.81	5.77	.00-	.00
44	1	.0200	15.56	22.78	.00-	.72	33.41	4.29	.04-	.83	38.81	4.78	.00-	.99
44	2	.0400	15.56	21.75	.00-	1.75	33.75	3.98	.30	1.14	39.41	3.94	.60	1.83
44	3	.0600	15.94	20.50	.38	3.00	33.79	3.83	.34	1.29	39.49	3.98	.68	1.79
44	4	.0800	16.55	20.39	.99	3.11	33.87	3.98	.42	1.14	39.64	4.51	.83	1.26
44	5	.1000	17.08	20.31	1.52	3.19	33.83	4.21	.38	.91	39.64	4.17	.83	1.60
44	6	.1200	17.05	20.16	1.49	3.34	33.72	3.98	.27	1.14	39.41	4.29	.60	1.48
44	7	.1400	17.08	20.73	1.52	2.77	33.75	4.21	.30	.91	39.53	4.70	.72	1.07
44	8	.2025	18.19	22.93	2.63	.57	33.11	6.34	.34-	1.22-	38.62	6.98	.19-	1.21
44	9	.2650	16.63	24.41	1.07	.91-	32.54	6.22	.91-	1.10-	38.24	7.40	.57-	1.63
44	10	.3275	17.16	23.24	1.60	.26	33.22	4.67	.23-	.45	39.15	5.31	.34	.46
44	11	.3900	16.78	23.65	1.22	.15-	33.53	4.48	.08	.64	38.92	4.97	.11	.80
44	12	.4525	16.74	23.73	1.18	.23-	33.26	5.43	.19-	.31-	39.03	5.35	.22	.42
44	13	.5150	17.08	23.35	1.49	.15	33.64	4.63	.19	.49	39.15	4.89	.34	.88
44	14	.5775	16.97	23.39	1.41	.11	33.60	4.36	.15	.76	39.30	4.36	.49	1.41

TEST SUBJECT 5%til• DUMMY

TEST NO	PT NO	TIME	TEMPLE X	TEMPLE Y	TEMPLE □X	TEMPLE □Y	EYE ^	EYE Y	EYE □X	EYE □Y	NOSE X	NOSE Y	NOSE □X	NOSE □Y
44	0	.0000												
44	1	.0200												
44	2	.0400												
44	3	.0600												
44	4	.0800												
44	5	.1000												
44	6	.1200												
44	7	.1400												
44	8	.2025												
44	9	.2650												
44	10	.3275												
44	11	.3900												
44	12	.4525												
44	13	.5150												
44	14	.5775												

TEST NO	PT NO	TIME	SHOULDER X	SHOULDER Y	SHOULDER □X	SHOULDER □Y	THIGH X	THIGH Y	THIGH □X	THIGH □Y	KNEE X	KNEE Y	KNEE □X	KNEE □Y
44	0	.0000	18.30	19.10	.00-	.00	30.38	5.08	.00-	.00	36.26	5.08	.00-	.00
44	1	.0200	19.10	18.07	.80	1.03	31.44	4.44	1.06	.64	37.44	4.40	1.18	.68
44	2	.0400	19.29	17.50	.99	1.60	31.70	4.55	1.32	.53	37.44	4.67	1.18	.41
44	3	.0600	18.11	17.92	.19-	1.18	30.53	4.63	.15	.45	36.38	4.63	.12	.45
44	4	.0800	18.15	18.00	.15-	1.10	30.64	4.59	.26	.49	36.38	4.74	.12	.34
44	5	.1000	18.34	17.73	.04	1.37	30.68	4.67	.30	.41	36.53	4.67	.27	.41
44	6	.1200	18.19	17.96	.11-	1.14	30.45	4.82	.07	.26	36.30	4.82	.04	.26
44	7	.1400	18.26	18.60	.04-	.50	30.41	5.08	.03	.00	36.38	5.12	.12	.04-
44	8	.2025	18.37	19.57	.07	.87-	30.07	5.46	.31-	.38-	36.00	5.31	.26-	.23-
44	9	.2650	18.15	19.63	.15-	.53-	30.26	5.16	.12-	.08-	36.15	5.20	.11-	.12-
44	10	.3275	17.96	18.53	.34-	.57	30.30	4.89	.08-	.19	36.19	5.05	.07-	.03
44	11	.3900	18.22	19.29	.08-	.19-	30.19	5.31	.19-	.23-	35.96	5.35	.30-	.27-
44	12	.4525	18.75	18.87	.45	.23	30.83	5.08	.45	.00	36.72	5.24	.46	.16-
44	13	.5150	18.15	19.79	.15-	.31	30.53	5.01	.15	.07	36.41	5.01	.15	.07
44	14	.5775	18.26	19.68	.04-	.42	30.45	5.01	.07	.07	36.26	5.05	.00-	.03

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This interim report concerns Phase I of a research program to determine if a correlation in displacements exists between humans and anthropomorphic dummies of like proportions when subjected to vertical crash type forces for extrapolation into the high impact region where only dummies can be utilized. Although similarities were found when comparing the displacements in the leg area, the upper torso could not be correlated in any but a highly complex way. Although direct correlation is not practical, much useful information has been gained. The dynamics of the human body as it affects the performance of pilot ejection systems is considered to be very significant, and as yet undetermined.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
1. anthropomorphic dummy 2. correlation 3. vertical impact 4. peak displacements 5. dynamic response						

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Ref: (a) Report No. NADC-AC-6808, "Comparative Study of Body Displacements in Both Humans and Anthropomorphic Dummies When Simultaneously Subjected to Controlled Vertical Impact Type Decelerations" of 8 Apr 1968

Encl: (1) Three separation pages for Figures 2 through 65
(2) Pages vii and viii

1. Because of an error in the figures contained in the reference (a) report, it is requested that the following action be taken:

a. Replace the three separation cover sheets that indicate Figures 2 through 106 with the corresponding pages contained in enclosure (1), which contain the correct number of figures 2 through 65.

b. Place the figures in the proper consecutive order.

c. Replace pages vii and viii with enclosure (2).

d. Page 3, paragraph 2, last sentence, change "(Figures 2 through 106)" to "(Figures 2 through 65)".

L. W. Meakin

L. W. MEAKIN
By direction

LIST OF FIGURES

LIST OF TABLES

FIGURES 2 THROUGH 31

DATA PLOTS OF C. BROOKS AND 95 PERCENTILE DUMMY

TEST NO.	G LEVEL	IMPACT VELOCITY
34	4.9	44 FPS
39	9.0	33 FPS
40	10.0	33 FPS
60	8.4	33 FPS
61	8.1	44 FPS

FIGURES 32 THROUGH 46

DATA PLOTS OF L. REED AND 5 PERCENTILE DUMMY

TEST NO.	G LEVEL	IMPACT VELOCITY
41	4.9	44 FPS
42	7.1	44 FPS
43	9.0	33 FPS
44	10.0	33 FPS

FIGURES 47 THROUGH 55

DATA PLOTS OF D. BRICE AND 50 PERCENTILE DUMMY

TEST NO.	G LEVEL	IMPACT VELOCITY
36	4.9	44 FPS
37	7.1	44 FPS
45	9.0	33 FPS
46	10.0	33 FPS